Engineering Library

AUG 8 1921


# AUTOMOTIVE INDUSTRIES
## The AUTOMOBILE

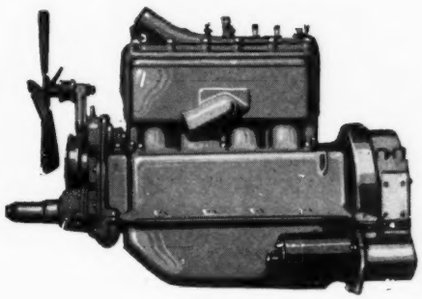
Vol. XLV
Number 5

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, AUGUST 4, 1921

Thirty-five cents a copy
Three dollars a year



## Nine Out of Ten People Are Buying "Fours" *



THE multi-cylinder cars have a distinct place in the automobile market, from which they cannot be displaced.

Yet their market is not only small, but is essentially different from the big, broad market where the initial investment is more of a determining factor of choice.

In this big market competitive models have been less numerous among the "Fours," a fact of importance to the car manufacturer.

Only 35% of all makes are "Fours," but 90% of all cars sold are "Fours."

This increasing preference for "Fours" by the buying public is undoubtedly due to the fact that, with the right four-cylinder motor, the car manufacturer can offer all of the essential things any motor can do and at the same time build appealing quality and value into the rest of the car to a degree impossible with more cylinders at the same price range.

In an unusual way, the Lycoming Motor qualifies for leadership among the four-cylinder engines.

Find out about this four-cylinder engine—Model K, Lycoming Motor.

**Lycoming Motors Corporation**
**Williamsport, Pa.**

*Exclusive of Fords.

The LYCOMING MOTOR

LYCOMING MOTORS CORPORATION


Entered as second-class matter Jan. 2, 1906, at the post office at New York, N. Y., under the Act of March 3, 1879.

# FEDERAL BEARINGS

## UNIFORMITY

The Babbitt lining in every Federal Bearing shows the same tough, fine-grained, homogeneous structure because every Bearing is chilled immediately after it is lined.

## SOLIDITY

Every Federal Bearing is guaranteed absolutely free from porosity, because the process of manufacturing makes it impossible for the Babbitt to contain air while cooling.

## 100% BOND

Unlike all other methods of manufacturing Bearings, the Babbitt lining and Bronze Back of every Federal Bearing is Bonded UNDER PRESSURE while the adhering alloy is at a constant temperature.

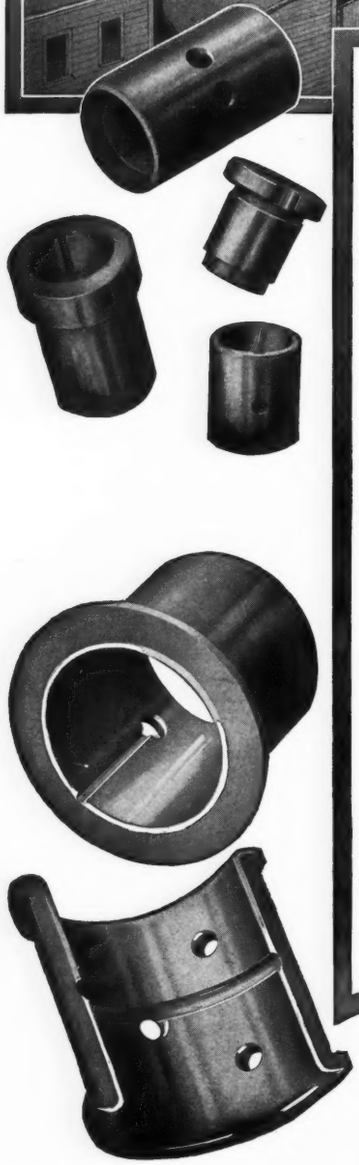
## EXCELLENCE

Every Federal Bearing is manufactured from the highest grade materials, machined accurately and subjected to the most rigid inspection, because "FEDERAL, DETROIT" must be stamped on the back.

**EVERY FEDERAL BEARING IS LINED BY**

# CENTRIFUGAL FORCE

(Process protected by patents)



# FEDERAL BEARING & BUSHING CORPORATION

**BABBITT-LINED BRONZE-BACK BEARINGS_BRONZE BUSHINGS_BRONZE CASTINGS**

**DETROIT — MICHIGAN**

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XLV. NEW YORK—THURSDAY, AUGUST 4, 1921 No. 5

# Trends in the Petroleum Industry for First Half of 1921

## Production and imports of crude, and consumption of gasoline exceed figures for first half of 1920. Imports from Mexico which are now falling off, have prevented possible shortage in total supply here.

By Joseph E. Pogue[1]

THE petroleum industry was among the last to be affected by the industrial depression.[2] Although showing signs of succumbing in late 1920, the industry had gathered so much momentum that it ran over into 1921 before the reaction fully came. In February, however, a sharp break in prices occurred and from then on the process of general liquidation was drastic.

**But in spite of all depressing influences, the actual production of crude petroleum, under the impetus gained in 1920, has gone on increasing; and even petroleum refining, closely linked with crude production, has displayed only a moderate curtailment, as compared with the recession in manufacturing activities in general. Thus large stocks of both crude and refined products have accumulated.**

**A unique factor in the petroleum situation is an increase in the demand for one of the products, gasoline, accompanying greatly lessened requirements for kerosene, fuel oil, and lubricating oils —an unbalanced market condition which has created perplexing problems.**

Coincident with full production at home and a set of demands badly out of balance, the oil fields of Mexico have been exploited with redoubled intensity, under the spur of a keen competition and the menace of salt water encroachments. In consequence, a flood of imported oil has come upon the domestic market to add to the demoralization.

**The feature of greatest interest to the automotive industry is the now well demonstrated fact that petroleum, because of peculiarities incident to its exploitation, does not conform closely to the economic cycle, but displays a lag of some six to twelve months.**

That is to say, at any given moment the production of crude petroleum (and refinery activity to a modified extent) is responding to the stimulating or depressing influences of conditions months in the past. Thus during the first half of 1921, a period when production in general was running at half capacity, the output of crude petroleum broke all previous records.

**Conversely, at the next turn ahead, when demands revive, the output of crude petroleum may be expected to display the deferred effects of the present time of depression.**

[1] Consulting Engineer, New York.

[2] The statistics presented in this review were derived from the following sources: Data on crude petroleum from U. S. Geological Survey and American Petroleum Institute; refined products from U. S. Bureau of Mines; well data from Oil and Gas Journal; export figures from U. S. Bureau of Foreign and Domestic Commerce; prices calculated by the writer from quotations given in The National Petroleum News, and The Oil, Paint, and Drug Reporter.

The production of crude petroleum in the United States increased from 211 million barrels during the first half of 1920, to 237 million barrels in the first six months of 1921—an advance of 12 per cent. At the same time the corresponding imports of crude petroleum grew from 39 million barrels to 66 million barrels. These imports came practically entirely from Mexico. The consumption of crude petroleum during the two half-year periods under view increased 5 per cent, but this change is scarcely a measure of demand since part of the petroleum consumed by refineries went merely into the building up of stocks of refined products. A review of the crude petroleum situation is presented in Table I.

Of greater significance than the half-year record is the trend of the significant items, and the course of production and imports of crude petroleum in the United States by months for the period 1918-1921 is shown in Fig. 1. The chart is drawn on a ratio scale in which the slopes of the curves are proportional to the percentage changes.

**The failure of the curve of production to accommodate itself to the depressed demand of the current year is at once to be noticed, as well as the prominent part played of late by imported oil, that is, Mexican petroleum. Imports reached their peak in late 1920, but the decline in 1921 has not been great relative to the lessened requirements.**

TABLE 1—COMPARISON OF THE CRUDE PETROLEUM SITUATION FOR THE FIRST 6 MONTHS OF 1920 AND 1921
(In millions of barrels)

| | First 6 months, 1920 | First 6 months, 1921 | Per cent change |
|---|---|---|---|
| Production | 211 | 237 | +12% |
| Imports | 39 | 66 | +69% |
| Exports | 4 | 4 | 0 |
| Stocks, Jan. 1 | 129 | 134 | + 4% |
| Stocks, June 30 | 127 | 179 | +41% |
| Domestic consumption | 247 | 260 | + 5% |
| Crude to stills | 196 | *219 | +12% |

*Approximate; June estimated.

### Oil Field Development

The production of crude petroleum is composed of the declining output of thousands of old wells plus the flush production of hundreds of new wells. The country's outflow of petroleum would gradually decline, were it not for the complement of new wells brought in each month. A study of drilling activity, therefore, gives a clew to future production, since the rate of decline of old wells is known.

During the first six months of 1921, there were 2675 fewer productive wells completed in the fields east of California than during the same period of the previous year. The total number for 1921 (6 months) was 8568, as compared with 11,243 in 1920 (6 months). The number of rigs up and wells drilling—an index of the work under way—has fallen from 11,087 in June, 1920, to 6418 in June, 1921. The main effect of this recession in preparation for production is yet to be felt.

The trend of new work and successful completions in the entire country exclusive of California is shown by months for 1920 and 1921 (6 months) in Fig. 2. The ratio scale permits the slopes of the two curves to be directly compared.

**It is at once apparent that drilling activity has fallen away nearly 50 per cent since its period of greatest intensity in 1920. The significant feature, however, is that the present decline is over the summer months (when drilling efforts are normally at their height) and during the coming winter the seasonal decline will still further cut down operations. Thus a gap is created in the productive effort that can be made up with difficulty when an increasing production comes to be required.**

During the past few months there has been a change in the type of territory subjected to drilling. Ordinarily, a large share of drilling efforts are directed to pioneer acreage.

**Of late, under the low prices prevailing, the drill has been directed almost wholly to proven acreage where the chances of striking oil are good. The net effect has been an intensive development of blocked-out reserves. Such a policy, if long continued, will seriously retard the gaining of an increased production later on.**

During the year two new oil pools were opened up—the El Dorado in southern Arkansas and the Haynesville in northern Louisiana. During the week ending July 9, the estimated daily output of these two pools was 52,000 and 10,450 barrels respectively, together 4.76 per cent of the country's total production. The development of these two pools has contributed substantially to the increase in domestic production that has characterized the first part of 1921. The bringing in of new territory at a time when the oil was not needed reflects the tendency of petroleum production to proceed independently of outside conditions.

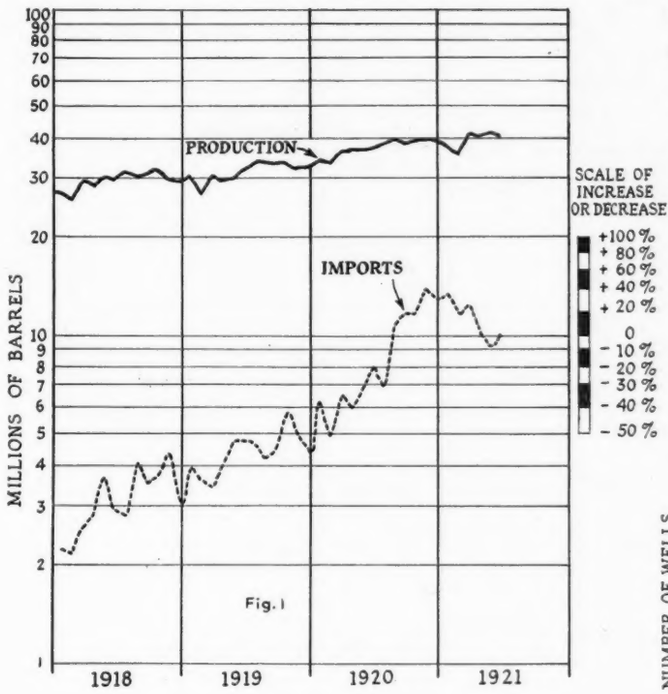
### Mexico

**The production of crude petroleum in the United States for a number of years has fallen short of domestic requirements, not through any failure on the part of production, which has gone on increasing, but because demand has been growing at a rate which could not be paralleled by output. The degree to which this country has grown into petroleum dependence upon outside sources of supply is indicated by the fact that at the beginning of 1921 one-fourth of our crude petroleum was coming from Mexico. This proportion fell to about one-fifth during early 1921, but without imported oil even the depressed demands of middle 1921 could scarcely have been satisfied.**

In view of the important bearing of Mexican petroleum upon industrial and automotive activities in the United States, the reports as to the rapid exhaustion of the producing pools in Mexico have proven disquieting. It is not generally realized that the proven oil pools of Mexico are confined to a small area in the Tampico-Tuxpam region, which was responsible for a quarter of the world's output of petroleum in 1920. Outside of this single area, there are promises of oil in several localities, but as yet no important commercially developed deposits; relatively little development work, in fact, has been done outside the proven area, which will have a retarding effect on future production.

Widespread attention was attracted by an address on the oil situation made by Ralph Arnold, a prominent petroleum engineer, before the American Institute of Mining and Metallurgical Engineers on February 16, 1921, in which the following statement was made regarding the proven oil pools of Mexico:

"Now let us turn to some concrete figures regarding the immediate future in Mexico: There have been twelve proven important pools: Ebano, Panuco, Topila, Dos Bocas, Tepatate, Casiano, Chinampa, Los



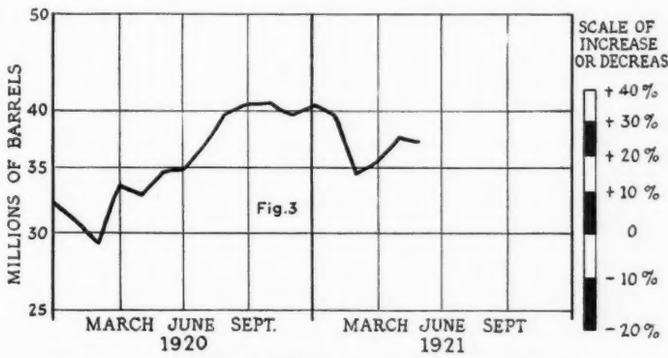




Fig. 1—Trend of production and imports of crude petroleum by months, 1918-1921

Fig. 2—Trend of oil-field activity east of California by months, 1920-1921

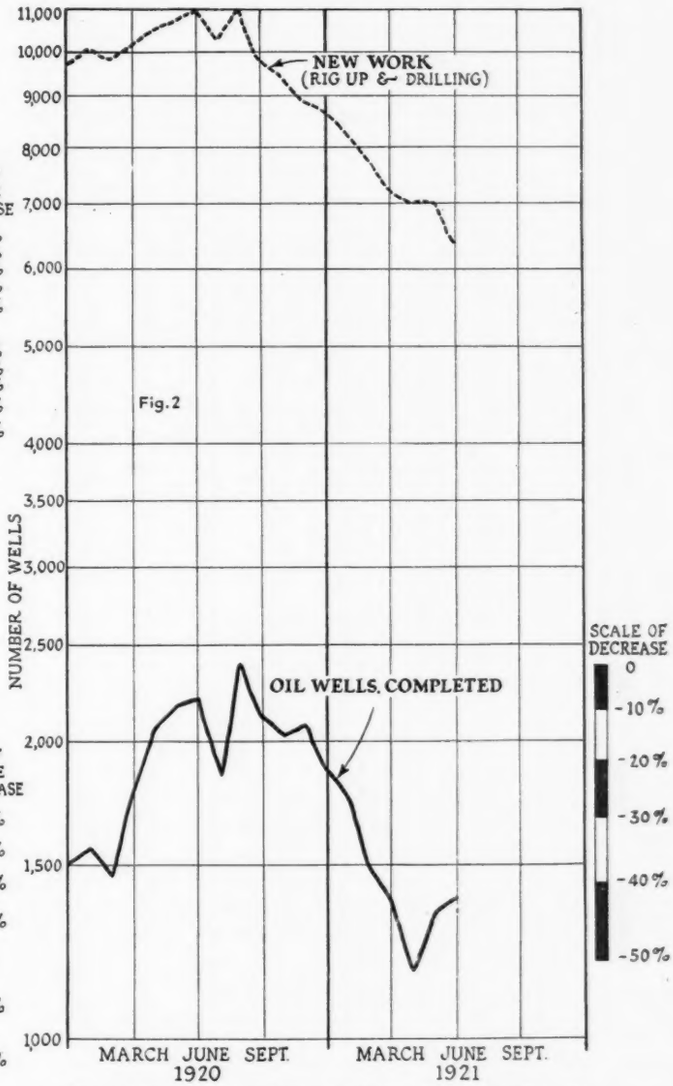



Fig. 3—Trend of refinery activity—the quantity of crude petroleum run to stills by months, 1920-1921

Naranjos, Zacamixtle, Cerro Azul, Potrero del Llano and Alamo. Of these Dos Bocas, Tepatate, Casiano, Chinampa and Potrero del Llano are extinct; Los Naranjos, Panuco and Alamo are rapidly going to salt water, and, with the exception of Panuco, as far as important production is concerned, are, or soon will be, unimportant. Panuco and Ebano, apparently will continue for many years producing enough oil and a valuable mixture of oil and water to have an important bearing on the productivity of Mexico. This leaves Zacamixtle, a practically virgin pool, and Cerro Azul, a partly exhausted pool, the latter controlled by a single company, to furnish, with Panuco, the bulk of the proven future supply. Of the exhausted pools, the greatest only produces a little over 120,000,000 barrels. Los Naranjos will probably produce a total of over 150,000,000 barrels. These oil pools compared favorably in area with the present producing pools, so that these latter may be assumed to yield no large excess over the maximum so far attained. Estimates of future production are: Zacamixtle, over 125,000,000 bbl.; Cerro Azul, 75,000,000 bbl. remaining; Alamo, 25,000,000 bbl. remaining; Los Naranjos and Panuco, each 50,000,000 bbl. remaining; total, 325,000,000 bbl. Last year Mexico produced 185,000,000 bbl., or an average of about 500,000 bbl. per day. Mexico is now producing at the rate of about 600,000 bbl. per day; approximately two-thirds of this is coming from Los Naranjos, a pool which will probably be extinct by early summer on account of the encroachment of salt water. If the present rate is maintained throughout the year, 1921 will see about 220,000,000 bbl. of oil brought to the surface in Mexico, or about one-half the probable production of the United States for the year. But Mexico's proven reserve is less than twice this amount, hence, at the present rate of production, the latter part of 1922 will see the end of the proven big fields in Mexico. There is little wildcatting going on in Mexico now, probably not over 25 strictly wildcat wells now being actively drilled outside the main producing district. Whether it is 1½ years or 2 years, or even a little longer or a little less before the break comes, it is certain to come."[1]

The reader should hold clearly in mind that the statement quoted above refers to the **proven** oil pools of Mexico. Other deposits will certainly be developed in Mexico, but the pools now contributing so bountifully are not limitless and are showing signs of approaching exhaustion.

Arnold's analysis has aroused considerable discussion and difference of opinion. While some of the **proven pools** referred to may be extended by further drilling and the limits of the Zacamixtle pool have apparently

[1] The Oil Situation, Mining and Metallurgy, Mar., 1921, pp. 20-21.

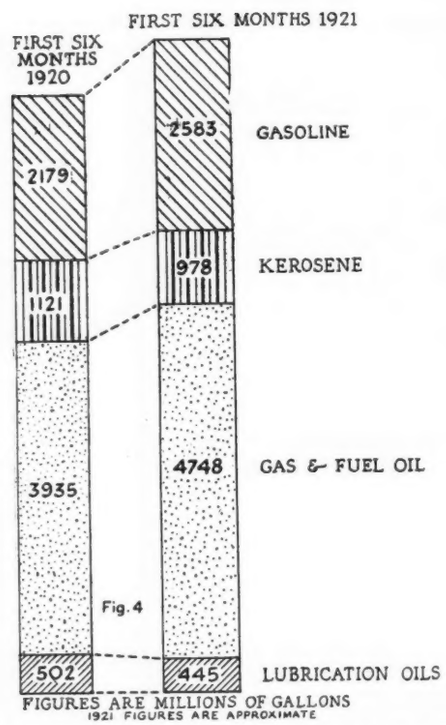



Fig. 4—Production of petroleum products in the United States during the first six months of 1920-1921

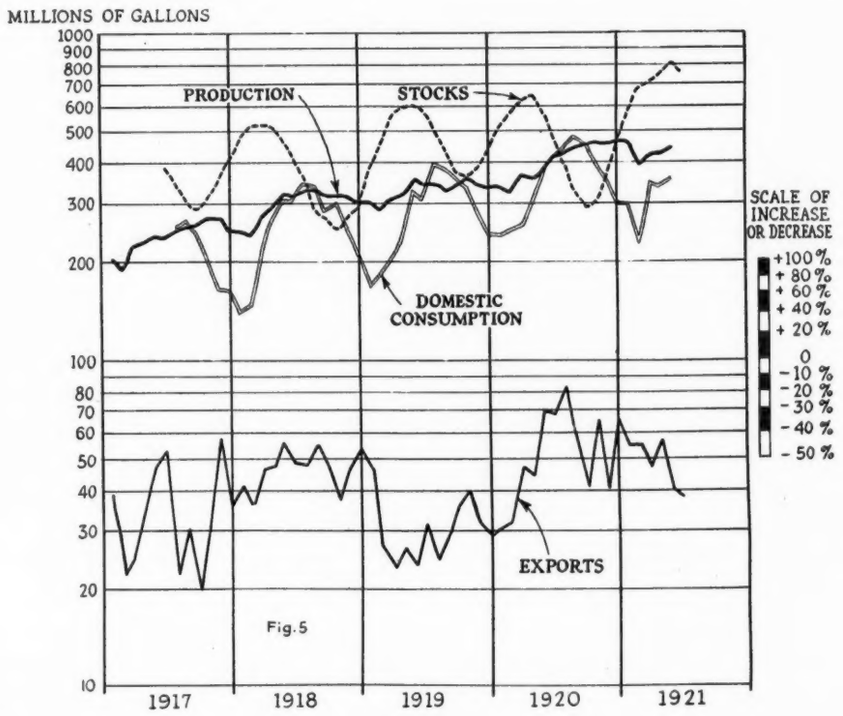



Fig. 5—Trend of the gasoline situation by months, 1917-1921

already been enlarged during the first six months of 1921, the statement by Arnold is deserving of close consideration.

**Should the curve of Mexican production turn sharply downward in 1922 or 1923, the effect upon the petroleum situation in the United States will be significant.**

### Refinery Activity

The best index of refinery activity is the quantity of crude petroleum run to stills and the trend of this factor by months is reflected in Fig. 3. Reference to this chart will disclose the rapid increase in refining activity throughout the second and third quarters of 1920; the maintenance of a high level of productivity the fourth quarter; and a slight recession during the first half of 1921. The moderation of the curtailment in crude run to stills in early 1921 is striking, in view of the drastic recessions both in productive activities in general and in demands for most of the petroleum products. The relatively vigorous status of petroleum refining was due partly to the attempt of refineries to accommodate producers and in part to the increased demand for gasoline which could not have been met if refinery output had been trimmed to the measure of the market for kerosene, fuel oil, and lubricants.

On January 1, 1921, there were 415 refineries in the United States with a daily capacity of 1,888,800 barrels, as compared with 373 refineries with a daily capacity of 1,530,565 barrels a year previous. During 1920, therefore, refinery capacity in the United States increased 23 per cent.

**On January 1, 1921, the proportion of the installed capacity being utilized was 68 per cent. As refining was virtually at its highest point at this time, the figures quoted indicate the extent to which the refining industry was overbuilt relative to normal requirements.**

The output of the leading petroleum products—gasoline, kerosene, fuel oil, and lubricating oils—for the first six months of 1921 as compared with the corresponding period of 1920, is given in tabular form in Table 2 and shown graphically in Fig. 4. It will be observed that gasoline and fuel oil have increased in output 19 per cent and 21 per cent respectively; while kerosene and lubricating oils have declined. This differ-

TABLE 2—U. S. PRODUCTION OF PETROLEUM PRODUCTS DURING FIRST 6 MONTHS OF 1920 AND 1921
(Unit: 1,000,000)

| | First 6 months, 1920 | *First 6 months, 1921 | Per cent change |
|---|---|---|---|
| Crude run (bbls.) | 196 | 220 | +12% |
| Oils purchased and re-run (bbls.) | 19.3 | 17.8 | — 8% |
| Gasoline (gals.) | 2,179 | 2,583 | +19% |
| Kerosene (gals.) | 1,121 | 978 | —13% |
| Gas and fuel oil (gals.) | 3,935 | 4,748 | +21% |
| Lubricating oils (gals.) | 502 | 445 | —11% |

*Approximate; includes estimated figures for June.

TABLE 3—ENDPOINT OF MOTOR-GASOLINE IN SELECTED CITIES IN 1920 AND 1921
(Data from U. S. Bureau of Mines)

| | Endpoint in Degrees Fahrenheit | | | |
|---|---|---|---|---|
| | April, 1919 | Jan., 1920 | July, 1920 | Jan., 1921 |
| New York | 411 | 418 | 432 | 417 |
| Washington | 426 | 439 | 449 | 439 |
| Pittsburgh | 425 | 425 | 454 | 430 |
| Chicago | 423 | 445 | 455 | 439 |
| New Orleans | 435 | 424 | 445 | 428 |
| Salt Lake City | 441 | 440 | 456 | 439 |
| San Francisco | 374 | 406 | 428 | 417 |
| Average | 417 | 427 | 446 | 429 |

ence reflects the lack of balance obtaining between the several demands for petroleum products.

### Gasoline

The trend of the gasoline situation by months from 1917 to the present is shown in Fig. 5. The chart is drawn on a ratio scale so that the percentage changes as well as the quantity changes may be directly observed and compared.

**The trend of the output of gasoline over the period shown indicates an annual increase of approximately 18 per cent; this rate also measures the increase in demand. The gasoline requirements of the current year show some recession from the past trend, though they are still 10 per cent in advance of the requirements of a year ago. An increase of this magnitude in the domestic demand for gasoline during a period of industrial depression is a striking commentary on the essential character of automotive transportation.**

The marked seasonal character of the curve representing gasoline stocks is noteworthy. In spite of the current increase in gasoline requirements, production this year has been amply maintained. Gasoline stocks usually start to decline in April, but this May saw a sharp increase instead of the usual recession. The flexure in the curve reflecting this feature is an indication of the extent to which the petroleum industry has maintained production in the face of a general industrial decline.

The United States Bureau of Mines conducted its usual semi-annual chemical survey of motor-gasoline in January and the summarized results are shown comparably in Table 3. It will be noted that the average endpoint was approximately the same in Jannary, 1921, as in January, 1920, and notably less than in July, 1920. The average endpoint of gasoline is always less in winter than in summer by virtue of the lessened demand in cold weather; but the normal increase in endpoint that has characterized the past five years is slowing up this year in keeping with an "easy" supply. The endpoint of gasoline is a function of the degree of stress between supply and demand, modified by the season. If its past behavior is any criterion of the future, **the endpoint will reassume its upward trend as soon as demand begins again to take the lead over supply.**

TABLE 4—EXPORTS OF PETROLEUM PRODUCTS DURING THE FIRST 6 MONTHS OF 1920 AND 1921
(In millions of gallons)

| | First 6 months, 1920 | First 6 months 1921 | Per cent change |
|---|---|---|---|
| Gasoline and naphtha. | 292 | 292 | 0 |
| Kerosene ..... | 424 | 386 | — 9% |
| Gas and fuel oil..... | 411 | 436 | + 6% |
| Lubricating oils ..... | 209 | 137 | —34% |

### Other Products

The production of kerosene has fallen rather sharply throughout the first six months of 1921, in keeping with a much reduced demand. The disposition of kerosene, indeed, has proved an embarrassing problem to many refiners, and in some quarters the product has been lumped with fuel oil in the absence of an adequate market for its separate disposition.

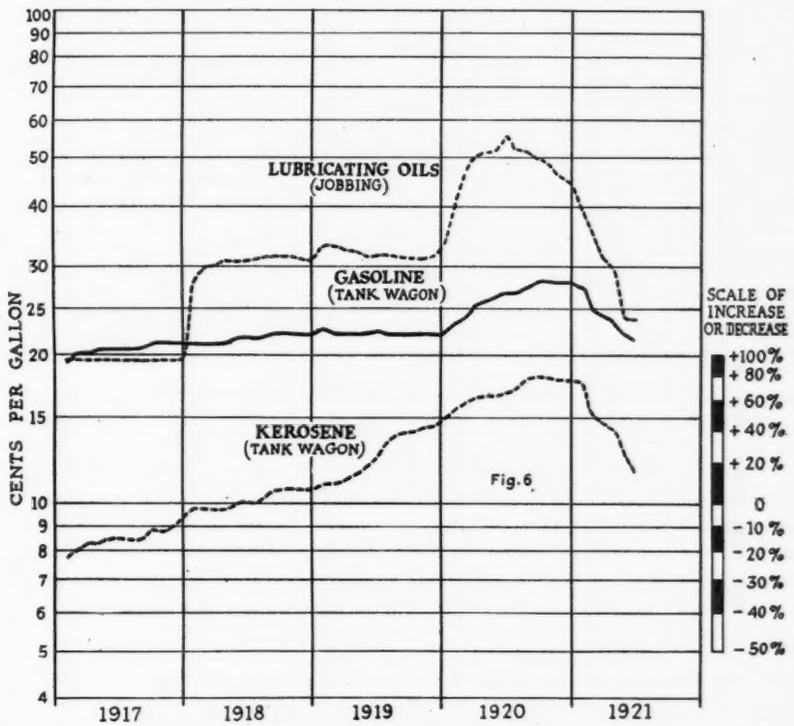



Fig. 6—Trend of the average prices of gasoline, kerosene, and lurbicating oils by months, 1917-1921

Fuel oil has also been piling up on the refiners' hands because of the curtailment in industrial and shipping activities. Much of the imported crude is turned into this product and it is also produced perforce in the manufacture of gasoline. The close relationship between gasoline and fuel oil as joint-products always causes trouble when the demands for the two get out of step.

The demand for lubricating oils suffered serious curtailment during 1921, following closely upon the marked stimulation in output that characterized 1920. Between Setpember 30 last and April 30 the stocks of lubricating oils on hand in the United States have doubled.

### Exports

In common with other productive activities, **the petroleum industry has suffered from a sharp decline in its export trade.** This condition has proved particularly troublesome in respect to kerosene and lubricating oils, the two products that normally go abroad in greatest proportion.

Exports of the four major products of petroleum for the first half of 1920 and 1921 are compared in Table 4, where the degree of the recession in the foreign demand is at once apparent.

The vigorous entry of foreign countries into oil field development may be expected to bring growing competition into the overseas markets for oil products and thus restrict this outlet for American oils.

### Prices

As may readily be gathered from the foregoing discussion, the price situation in the petroleum industry has undergone a radical revision during the first six months of 1921. This situation is depicted in perspective in Fig. 6, where the trend of the average prices of gasoline, kerosene, and lubricating oils is shown by months from 1917 to the present. The sharp advances gained in

TABLE 5—TREND OF PRICES IN THE PETROLEUM INDUSTRY BY QUARTERS, IN PERCENTAGES OF THE AVERAGE PRICES IN 1913
(Average prices for 1913 = 100)

| | 1913 | 1919 | 1920 | | | | 1921 | |
|---|---|---|---|---|---|---|---|---|
| | | | 1st Q. | 2nd Q. | 3rd Q. | 4th Q. | 1st Q. | 2nd Q. |
| Crude petroleum (at wells) | 100 | 197 | 270 | 311 | 314 | 311 | 218 | 154 |
| Gasoline (tankwagon) | 100 | 142 | 154 | 169 | 176 | 179 | 164 | 143 |
| Kerosene (tankwagon) | 100 | 162 | 202 | 213 | 226 | 226 | 199 | 161 |
| Fuel oil (at refinery) | 100 | 147 | 233 | 288 | 286 | 226 | 149 | 116 |
| Lubricating oils (jobbing) | 100 | 209 | 293 | 344 | 336 | 302 | 224 | 167 |
| *All commodities | 100 | 212 | 250 | 269 | 251 | 207 | 169 | 151 |

*From U. S. Bureau of Labor Statistics.

early 1920 have been eliminated and petroleum prices have gone far toward their pre-war level. Thus in June of this year, the prices of mineral oils stood as follows, in percentages of the average prices prevailing in 1913: Crude petroleum, 127; gasoline, 137; kerosene, 146; fuel oil, 102; lubricating oils, 154.

Fig. 6 indicates that **the average price of gasoline in June, 1921, was approximately equal to the average price over the three year period, 1917-1919.** The price of lubricating oils, it may be observed, started downward the middle of 1920, shortly after commodity prices in general started to decline, and between June, 1920, and June, 1921, fell 58 per cent. The steady upward trend of the price of kerosene from the beginning of 1917 to late 1920 should not escape attention, as this move toward the level of gasoline was caused by the entrance of kerosene into use as a motor fuel.

The price of mineral oils compared with all commodities is shown by quarters in Table 5, in percentages of the prices prevailing in 1913. These composite figures are calculated from thousands of individual quotations and reflect with considerable verity the country wide levels attained during the period shown. The drastic liquidation in petroleum prices *per se* and relative to prices in general is definitely measured.

The actual prices of gasoline in a number of selected cities is given in Table 6 by months for 1921, compared with the average prices in 1913, 1919, and 1920. **While gasoline has a smaller percentage decline than its joint products, it had previously attained a less high level from which to recede.** The marked difference in level in various parts of the country is noticeable, the product being cheaper in the central states, where the bulk of the gasoline is produced.

Petroleum prices for a time were resistant to the downward price swing that accompanied the industrial depression, but they finally succumbed and soon made up for lost time in their downward course.

TABLE 6—WHOLESALE (TANKWAGON) PRICE OF GASOLINE IN SELECTED CITIES DURING 1921 COMPARED WITH PREVIOUS YEARS
(In cents per gallon)

| | New York | Baltimore | Chicago | Kansas City | San Francisco | Average |
|---|---|---|---|---|---|---|
| 1913 | | | | | | |
| Year | 16.8 | 15.8 | 14.8 | 15.2 | 15.4 | 15.6 |
| 1919 | | | | | | |
| Year | 24.5 | 22.5 | 21.1 | 21.8 | 21.1 | 22.2 |
| 1920 | | | | | | |
| Year | 29.4 | 27.8 | 25.4 | 25.4 | 24.5 | 26.5 |
| 1921 | | | | | | |
| Jan. | 31.0 | 28.3 | 26.6 | 24.9 | 27.0 | 27.6 |
| Feb. | 28.5 | 25.8 | 23.0 | 21.0 | 27.0 | 25.1 |
| March | 26.5 | 24.5 | 23.0 | 21.0 | 25.0 | 24.0 |
| April | 26.0 | 24.5 | 22.3 | 20.4 | 25.0 | 23.6 |
| May | 26.0 | 23.7 | 20.0 | 18.7 | 23.8 | 22.0 |
| June | 24.6 | 22.0 | 19.5 | 18.2 | 23.0 | 21.5 |

### Conclusions

The features of the half-year of special interest from the automotive viewpoint may be summarized as follows:

**(1) The domestic production of crude petroleum continued to increase despite a sharp decline in prices and demands.**

**(2) Prices of crude petroleum and its products displayed a sudden and spectacular recession.**

**(3) Oil field development suffered a notable curtailment, with an effect still to be felt.**

**(4) The stocks of both crude petroleum and its products accumulated in considerable volume.**

**(5) Refinery activity slowed down very slightly, considering the decline in the market.**

**(6) Mexico attracted widespread attention in respect to the encroachment of salt water in many of her wells.**

**(7) Export activity fell away to a consequential degree.**

**(8) Two new domestic pools were vigorously developed at an inopportune time.**

**(9) Petroleum came to the forefront as an international problem.**

## Fuel Developments Abroad

ONE of the last acts of the French Chamber of Deputies before adjournment was to authorize the Minister of Commerce to proceed with the production of the "native motor fuel" which is to be a substitute for gasoline and render France independent of Great Britain and the United States in this respect. This fuel is said to be the result of extended research work carried on at Government laboratories. René Faber, an engineer, is said to have succeeded in producing alcohol anhydrate, that is, alcohol combined with gasoline, which is then treated with acid and redistilled.

From Germany comes news of a new motor fuel named Tetraline. It is a by-product of the process of making coke from bituminous coal. One molecule of naphthaline, the coal tar product formerly used for making dyes, is combined with four atoms of hydrogen. The resulting product is technically known as tetra-hydronaphthaline, but for commercial purposes the name has been shortened to tetraline. It is a liquid as clear as water, with a specific gravity of 0.975. The boiling and ignition temperatures are both very high, and the freezing temperature is very low. These properties are said to make the new fuel particularly suitable for use in small bore, high speed engines. Owing to the high ignition temperature the fuel cannot well be used in low compression engines, but when mixed with somewhat more volatile fuels it can be used in the average gasoline engine, according to the inventors.

# Highway Transport the Greatest National Economic Problem

**Thirty educators and industrial leaders discuss importance of proper educational training for men who are to adjust this growing industry to the public needs. Highways and their use considered as one problem.**

THE proper construction and use of the highways is the greatest single economic question before the people to-day, was a statement frequently made at a recent gathering of economists at the University of Maryland. The meeting had been called by the Committee on Highway and Highway Transport Education with a view to getting expressions of opinion from engineers engaged in educational work, manufacturers and users of highway transport with the ultimate purpose of outlining an engineering educational course that can be recommended to universities interested in this line of work.

It was said repeatedly that the financing of highway projects had been a sort of haphazard affair which had borne good results on a wave of popular opinion in favor of good roads, but that, as many of the States and other civil divisions are nearing their legal limit of indebtedness for this purpose, more orderly methods of finance have to be found. The foundation of motor transport, of course, is based on the actual highway and without proper highways there can be no effective motor transport. Motor transport, in the minds of the men assembled, is of equal importance with that of any other branch of transportation and will, eventually become the vital link, as it is the feeder of railway and all other transportation. It was admitted by all concerned that at present much of the highway transportation is uneconomical because there is not the proper understanding of its importance to the public life and because of the small development of basic knowledge concerning it.

The topics on the program are illustrative of the objectives of the committee:

Highway Transport
Highway Finance
Economic Problems of Construction and Maintenance
Highway Administration
Cost Accounting in Highway Transport Operation
National and State Legislation

C. J. Tilden, Director of the Committee, called the meeting to order and introduced President Charles S. Howe of the Case School of Applied Science who served as chairman of the meeting.

A better understanding of the deliberations of the meeting probably will be gained through including here a list of those present:

A. F. Woods, President, University of Maryland.
George H. Pride, President, Heavy Haulage Company.
E. G. Sutton, Executive Secretary, National Association of Sand and Gravel Producers.
George A. Ricker, District Engineer, Portland Cement Association.
J. C. Marquis, Editor, *Country Gentleman.*
J. N. Mackall, Chairman, Maryland State Roads Commission.
W. E. McComas, Portland Cement Association.
W. K. Hatt, Professor of Civil Engineering, Purdue University, and Director, Highway Research, National Research Council.
J. C. Long, Educational Secretary, N. A. C. C.
W. C. John, United States Bureau of Education.
T. W. Allen, General Inspector, Bureau of Public Roads.
N. W. Dougherty, Professor of Civil Engineering, University of Tennessee.
H. G. McGee, Bureau of Municipal Research.
W. A. Bassett, Chief, Engineering Division, National Institute of Public Administration.
F. W. Fenn, N. A. C. C. Truck Committee.
George F. Zook, Chief, Division Higher Education, Bureau of Education.
W. T. Bawden, Assistant to Commissioner, Bureau of Education.
P. P. Claxton, formerly U. S. Commissioner of Education, Provost-Elect, University of Alabama.
J. G. McKay, Professor of Economics, University of Wisconsin.
Charles S. Howe, President, Case School of Applied Science.
H. G. Collins, The White Company.
E. J. Adams.
T. H. MacDonald, Chief, Bureau of Public Roads.
M. O. Eldridge, Director of Roads, A. A. A.
Maj. F. S. Besson, Corps of Engineers, U. S. Army.
Clyde Jennings, Managing Editor, AUTOMOTIVE INDUSTRIES.
J. R. Bibbins, Department of Transportation and Commerce, U. S. Chamber of Commerce.
A. J. Brosseau, President, International Motors Company.
A. M. Loomis, National Grange.
L. M. Estabrook, Associate Chief, Bureau of Markets and Crop Estimates, Department of Agriculture.
Charles L. Raper, Dean, College of Business Administration, Syracuse University.
Pyke Johnson, National Automobile Chamber of Commerce.
R. D. Chapin, President, Hudson Motor Car Company.
A. N. Johnson, Dean, College of Engineering, University of Maryland.
R. A. Hauer, International Motors Company.
J. W. Brooks, Director, American Highway Educational Bureau.
C. J. Tilden, Director, Highway and Highway Transport Education Committee.
C. D. Curtiss, Bureau of Public Roads.
S. S. Steinberg, Professor of Civil Engineering, University of Maryland.

This group of men, of course, did not gather to study the petty questions that are bothering the truck operator of to-day, nor were they interested in the troubles of any one road man. They were gathered to throw all troubles into the melting pot and to consider the proper method of solving the general highway transport problem of the future.

The suggestion that highway financing plans are in a bad way was made by MacDonald. He told of States and communities that are nearing their debt limit and of projects which are being held up because the bonds cannot be sold at the rate of interest authorized. This fact was referred to many times during the day. McKay, the Wisconsin University economist who is doing consulting work for the Bureau of Roads, read a paper in which he presented a new plan for the allotment of costs, according to benefits accruing. He advocated some radical departures from the present method of assessment and advocated a heavier burden on the present users of highways. His plan was not presented as a finished one but a tentative plan subject to further development. As a final thought, Adams suggested that it might be possible to put the present authorized highway bonds in a fund for which Fed-

eral currency might be issued, under the authority of the War Finance Board. His thought was based on the recently announced plan to assist the railroads. He held that highway transportation is as vital to the country as is railroad transportation—a conclusion in which all present agreed.

### Old Roads as Foundation for New

Mackall gave a new turn to the thought on financing when he said that too many roads which would serve perfectly well as foundations are being torn up to build entirely new roads. He told of work done in Maryland where roads that had been broken up under the heavy war time traffic between Washington and Philadelphia had been resurfaced at much less cost than a new road and are perhaps better than entirely new roads. His point was that engineers are sometimes overlooking assets in the present wornout highways.

Brosseau, speaking on financing, asked for closer inquiry into the needs of the community and the building of roads equal to the traffic that could be expected. There is an inclination to build for a greater need than exists, he thought, in this way wasting money and turning the taxpayers against the project.

Eldridge of the A. A. A. spoke of the need of a uniform traffic census system, as it is impossible to compare present census. Dougherty thought that the very basis of a highway course should be studied as to cost of maintenance, construction and the traffic census and the relation of the cost and expectancy to the property.

Dr. Claxton was impressed with the additional factor of value in the social advantages of a good highway system and asked that this be considered. He spoke of the satisfaction he felt in that the subject of transportation had been injected into the educational system during his term of office. He urged that the continuance of this work be supported as much good could be accomplished by the proper education of children both in an appreciation of the necessity of transportation and in safety. The actual nationalization of education on this subject in common with others must, he thought, come through the State universities.

### National Viewpoint Important

The need of a nationalization of thought and action on highway and highway transport was suggested by Chapin and this fact, too, was brought out by others many times during the day. Chapin said that the time has come when roads must return the cost dollar for dollar. In the past the money for construction had come too easily but that 21 billion of dollars had been invested in highway transport and it is time the subject was taken more seriously. The present maintenance, he said, was equal to that of railroad transportation, about 10 billion of dollars a year. The need now is for a national view of this question. Railroad and highway transportation should be considered together as transportation necessary to the prosperity and welfare of the nation. He said that in the study of highway transport, attention had been given to the truck alone but that it is necessary to include the passenger car which has become a vital factor in every-day life and which, through better manufacture and lower price of the next few years, will become even more closely entwined into daily life. The number of passenger cars traveling daily, he said, has become a problem that can not be ignored and because of the number of these cars, it can not be assumed that any road that will carry the heavy traffic is sufficient for the passenger car. This thought, too, was carried through the day, especially in the questions of traffic control, maintenance of highways and the necessity for a close study of maintenance. Chapin's point that too much is being spent on the maintenance of the vehicle because not enough is spent on the maintenance of the highways was accepted by the highway men.

The only prepared paper of the day, read by Hatt, set forth a tentative plan for the Highway Research Committee, Division of Engineering of the National Research Council. This paper consisted chiefly of questions which the Committee has set out to answer and was illustrated by a chart. It will be printed in an early issue of AUTOMOTIVE INDUSTRIES.

Pride and Estabrook were responsible for injecting some surprising figures into the discussion. Estabrook said that recently the Bureau of Markets and Crop Estimates had determined that 134,400,000 tons of farm produce had moved to market over railways. All of this had, of course, first been transported over the highway. To this must be added produce that is consumed at the end of its highway journey without being handled by the railroad. He had no figures as to manufactured articles that entered into highway transport.

### Effect of Highway on Truck Maintenance

Pride said that the 990,000 commercial vehicles in service to-day are valued at $500,000,000 and that the maintenance and depreciation cost of $3,300,000 annually is entirely too high, due to the fact that the highways are causing much damage. Motor trucking to-day is inefficient and there is much room for improvement. In his later remarks Pride carried this a bit further and said that an enormous cost is being paid by the public because there are so many failures in automotive transport work, due to a lack of proper education of the men who embark in the business. These men, he said, do not know the costs of their work or of maintaining equipment and their consequent failure puts a burden on the trucking industry and adds resistance to the sale of trucks. He strongly favored including a course in cost accounting in any study of motor transport. This view met with general approval. He said that at present there is an annual turnover of something like three billion dollars in this industry and that a study of cost accounting is imperative because of the amount involved. The inefficiency of present trucking, he said, is levying a tax on all commodities. Even the great industrial companies do not know to-day what a factor highway transportation is in the cost of their commodities. It is, he said, an entirely neglected subject.

The subject of administration of highways and highway transport was briefly discussed. Raper favored a State administration, which should be controlled by a national administration to bring about a more uniform plan of maintenance and a better understanding of the factors involved. He spoke of the developments in the work at Syracuse University as showing chiefly the lack of administration understanding.

The problem of personal safety on the highways was discussed by Long and Jennings. The former spoke of the steps now being taken to promote safety through schoolroom work and through essays. Jennings spoke of the need of a study of individual accidents to determine the cause and the evident failure that awaits the present popular idea that safety can be brought about by the licensing of drivers.

Legislation was only briefly referred to, as this organization has no lobby plans. It merely seeks a basis for the drafting of proper laws. Johnson advocated a course of study of the laws themselves so that the highway transport engineers of the future will be able to advise as to uniformity of laws with understanding. Several of the representatives of other related organizations presented the views of their respective associations on the subject and their offer of aid in legislative matters.

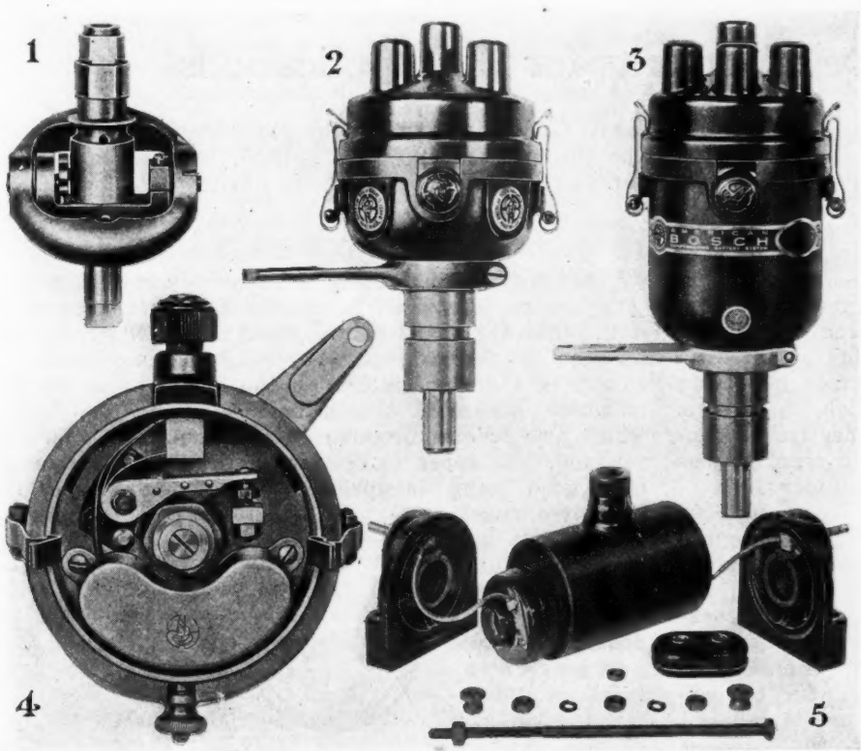
# Bosch Producing a Battery Ignition System

**Details of new electrical unit are given in the following description. Timer-distributor is made in two types arranged for automatic or manual advance. Interrupter is designed for high speed operation.**

IN the past the name Bosch has been associated chiefly with magnetos, but the American Bosch Magneto Corporation has decided to extend its line of products until it meets every electro-mechanical requirement of the motor car industry, and in accordance with this policy a battery ignition system has been brought out. The system comprises two units, the timer-distributor and the coil. The timer-distributor is available in two types, Type T and Type TM. Type T is used with what is known as the compensating battery ignition system, including a governor which through the intermediary of a cam advances the spark in accordance with the engine speed and the particular characteristics of the engine to which the system is fitted. Type TM is without the governor and is hand controlled, but otherwise is identical with Type T. Both systems are provided for 4, 6 and 8 cylinder engines.

The main housing of the timer-distributor, the lower end of which also constitutes the bearing for the timer shaft, is a gray iron casting, machined to receive the interrupter cup which rests in the upper section. In Type T the shell has sufficient depth to accommodate the governor mechanism. Spring clips hold the distributor cap in place, and permit ready inspection of the interrupter, condenser and distributor. When electric sparks occur for a considerable length of time in an enclosed space, nitric acid is formed, and ventilation is therefore necessary. In this particular instrument the ventilation is accomplished by using tubular rivets for the spring clips.

The timing arm is a drop forging and is mounted on a shoulder at the base of the main housing. It can be clamped in any angular position desired. By moving the main housing, the angular position of the interrupter cup and the distributor cap mounted thereon is changed in relation to the timer shaft and cam around which it moves, thereby advancing or retarding the spark without changing the angular relation of the distributor parts. Manual control may be used in connection with the compensating feature, this being convenient when the engine has to be started by hand cranking, for instance. In the compensating system lubrication of the bearing and governor parts is effected by a simple splash system, the governor ring dipping into oil in a sump in the shell and spraying it all over the interior parts.




Parts of Bosch battery ignition system. 1—Ring-type governor for controlling automatic advance. 2—Timer-distributor unit arranged for manual advance. 3—Timer-distributor containing automatic advance mechanism. 4—Interrupter mechanism. 5—Coil parts.

The interrupter is assembled in a cup which also contains the condenser, and the whole unit can be easily removed without disturbing its component parts or electrical connections. One of the advantages of the separate cup design for carrying the complete interrupter mechanism within an accurately ground recess in the main housing, is that the device is always assured of a proper position in relation to the supporting walls of the housing, thereby locating it correctly around the cam on the driving shaft. A thumb nut secures the cup in position and, together with the low tension terminal, provides handles for lifting the cup out for inspection purposes.

The interrupter lever is a one-piece steel stamping, copper and nickel plated. It is light but strong and rigid, and only light spring tension is required for its operation. Tests are said to have shown that the interrupter action is perfect even at speeds in excess of 5000 r.p.m. The lever is provided with a bronze bushing which turns on a hardened steel post, insu-

lated by means of a micarta plate. The interrupter is provided with a tinned copper shunt which, because of its lower electrical resistance, carries practically all the current, thereby obviating detrimental effects on the interrupter lever spring.

The condenser is of the dry-wound type, fully enclosed and sealed in a moisture-proof metal housing. It is located in the interrupter cup, and connected directly across the contact points.

The governor is of the "tilting ring" type, and, together with the interrupter cam and rotor, is carried on the timer shaft. The range of ignition advance is determined by an advance control stud integral with the governor mechanism.

As the timer shaft rotates, the tilting movement of the governor ring, due to centrifugal force, advances the interrupter cam, which is assembled to the timer shaft in the form of a sleeve, by direct engagement of a stud projecting into a slot provided in this sleeve. The total throw of the governor ring is adjusted by means of stop pins. Tilting of the ring is opposed by an adjustable spirally wound spring located in a recess in the bearing hub of the ring.

For the same general shape of characteristic curve, that is, the same percentage of movement at definite speeds, a total advance of from 0 to 60 deg. can be secured, measured on the engine flywheel. The advance may have a straight line characteristic or its characteristic may curve considerably. Changes in the characteristic of the advance may be brought about by means of stops for varying the range of travel of the ring, by varying the stiffness of the spring, by varying the initial setting of the spring and by changing the radius of the crankpin movement.

The distributor rotor, which is mounted on a projection of the cam and rotates with it, is provided with a skirt to protect the breaker mechanism. The rotor electrode is fastened by a screw into a recess on top, and is therefore removable. By reason of this method of attachment to the cam shaft, the rotor cannot be replaced incorrectly if removed for inspection. The distributor cap is mounted on top of the main housing, and is brought into alignment with the cam shaft by a slight projection of the interrupter cup over which it fits. A molded-in tongue fits into a slight recess in the housing, which prevents incorrect assembly.

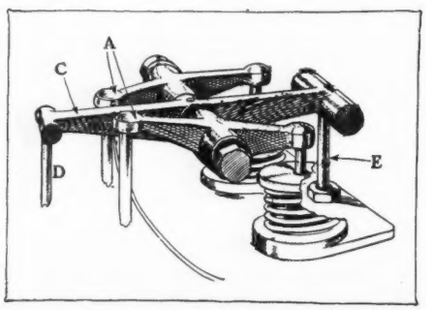
The ignition coil is of the dry-assembly type, as distinguished from coils which are sealed with insulating compounds. Its construction insures accessibility of all parts. It is mounted separately, preferably on the engine side of the instrument board. The core is laminated and permits the insertion of the center bolt holding the different units together. The soft iron band, together with the soft iron end plates, forms a shield for the magnetic circuit against the weakening effect of neighboring bodies of iron or steel, which is said to materially increase the spark energy. The high tension cable terminal is mounted in the center of the tubular casing surrounding the coil, and can be adjusted to any angular position by loosening the center bolt and swinging this casing to the position desired. This was made possible by connecting one end of the secondary to the magnetic shield surrounding the coil, and by providing a spring contact on the cable terminal inside the coil case.

The same coil is used in connection with 4, 6 and 8 cylinder timer-distributors and operates on 6 to 12 volt systems—the only change necessary being to select the proper ballast coil, there being one for six volts and one for twelve volts. The ballast coil (or resistance unit) is electrically connected in series with the primary winding. It protects the coil from burning out in case the engine is left with the battery switch in the "on" position with the interrupter contacts closed, and it also tends to produce a more uniform spark at different engine speeds.

# Two British Developments for Car Applications

## Constant Tappet Clearance

TO overcome the tendency of valve clearances to be varied by the unequal expansion which occurs in overhead valve engines, particularly in those having air-cooled or aluminum cylinders, the compensating gear illustrated herewith has been introduced in England. The action of the device provides a canceling motion, which keeps the tappet clearance unaltered. The valve rockers, A, instead of having their pivots mounted on a column directly attached to the cylinder head, are pivoted to a compensating lever, C, which, in turn, is pivoted to the column, E, and at the other end is supported by a tie rod, D, connected to the crankcase or cylinder foot.

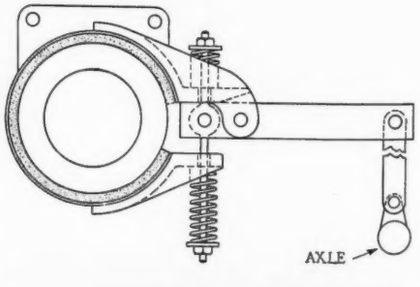


Constant tappet clearance device

By suitably proportioning the levers, the extent to which the pivot of the rockers is raised by the increase of cylinder temperature is reduced to the amount necessary to keep the clearance unaltered. The lever, C, does not add to the reciprocating weight, and the tie rod, D, can, it is claimed, be used to provide tappet adjustment or provision having the same effect.

## New One-Way Spring Damper

A SPRING damper acting in one direction only, which has recently been introduced in England by Barduff, Limited, has at least the merit of simplicity, as will be seen by the accompanying cut. Inclosed within a casing is a drum attached to the frame by a flanged member. Encircling this drum is a fabric-lined brake which acts in one direction only—namely, to damp out rebound, the upper movement of the axle relative to the frame being unimpeded. The extended lever is, of course, shackled to the axle by a pivoted link; adjustment of the damping effect is provided by nuts respectively above and below the two coil springs, which keep the band in contact with the drum.



One-way spring damper

# The Influence of Various Fuels on Engine Performance

## Part V.

**The relation between mixture strength and indicated mean pressure for various fuels, compression ratios and spark timing is shown and the influence of jacket water temperature and heating of charge determined. Efficiency at reduced loads and when using alcohol is also investigated.**

By H. R. Ricardo*

BEFORE any serious tests were commenced on the variable compression research engine, Messrs. Tizard and Pye had undertaken an exhaustive investigation into the process of combustion, and had arrived at very definite conclusions, both as to the chemical changes which might be expected to take place, and as to the limits of thermal efficiency resulting therefrom. Subsequent tests on the two research engines, more particularly on the variable compression engine, and on various fuels, have served to confirm the conclusions they arrived at. The close agreement obtained during tests carried out comparatively recently with their figures deduced many months previously, and from purely theoretical reasoning, is very striking. The writer gives here only the barest summary of their conclusions.

The thermal efficiency obtainable with any fuel depends in the first place upon the compression ratio at which it can be burnt, and this in turn is governed by the tendency of the fuel to detonate under high compression pressures. At any given compression ratio the thermal efficiency is dependent upon the maximum temperature. Upon flame temperature depends also the direct loss of heat to the cylinder walls, the loss due to dissociation, and that due to increase in the specific heat of the working fluid at high temperatures. The maximum temperature is dependent upon the mixture strength and the available internal energy of the fuel.

The whole question of the extent and influence of dissociation and the change in specific heat at high temperatures was dealt with very thoroughly by Messrs. Tizard and Pye. Broadly speaking, the results of their theoretical investigations have been to indicate:

(1) That when both change in specific heat and dissociation are taken into account the maximum temperature obtained with economical mixture strengths is substantially the same in the case of all available hydrocarbon fuels, though it is perceptibly lower in the case of alcohol.

(2) That the gain in efficiency with increase in compression ratio is very considerably greater than would be predicted from the air cycle formula.

(3) That the theoretical thermal efficiency for the most economical mixture strength may be expressed by the formula $E = 1 - \left(\frac{1}{r}\right)^{0.295}$.

This formula takes into account both change of specific heat and the effect of dissociation, and represents the ideal efficiency obtainable from a working fluid consisting of air and any volatile hydrocarbon fuel, assuming complete combustion (within the limits imposed by dissociation) and no loss of heat to the cylinder walls.

In Fig. 15 are shown three curves: (a) the air cycle efficiency for a range of compression ratio from 4:1 to 7.5:1; (b) Tizard and Pye's ideal thermal efficiency corresponding to the same range of compression, and (c) the observed results on the variable compression engine with most economical mixture strength based on the net calorific value of the fuel and including the latent heat of evaporation. It will be observed that throughout the whole range the relation between the experimental results and the calculated ideal efficiency is constant to within very narrow limits. The difference between the two represents the heat loss to the cylinder walls during combustion and expansion, and the small loss due to the early opening of the exhaust valves. All the tests showed that the gain in efficiency with increase in compression was almost exactly the same in the case of all fuels tested. Naturally, the majority of the fuels would not stand so high a compression ratio as 7.5:1 without detonation or pre-ignition, but up to the highest useful compression for each fuel the curves of efficiency plotted against compression ratio were almost coincident in all cases. Alcohol, for reasons which will be dealt with later, gave a higher thermal efficiency throughout the range of compression, though the curve showed practically the same proportional variation.

The determination of the true absolute thermal efficiency obtainable from different fuels has proved somewhat difficult. Such a determination pre-supposes an accurate knowledge of the effective calorific value of the fuel, and it is in acquiring this that the principal difficulty lies. Much of the published data is clearly unreliable, and must be discarded, while in many cases the very precision with which the calorific value is given to four, or even five, places is sufficient to engender suspicion in view of the great difficulty in the way of making an accurate determination. In regard to the application of the calorific values, as determined, to the calculation of engine thermal efficiency, there is a factor which does not appear to have been taken into consideration in previous investigations on this subject. This factor is the influence of the latent heat of evaporation upon the evaluation of the useful calorific value.

When a sample of liquid fuel is tested either in a Junkers or a bomb calorimeter, some at least of the heat liberated during combustion is devoted to overcoming the latent heat of evaporation of the liquid. In the case

*From a preliminary report (slightly condensed) on research work conducted by the author and other investigators for the Asiatic Petrolium Co. and published in the Automobile Engineer.

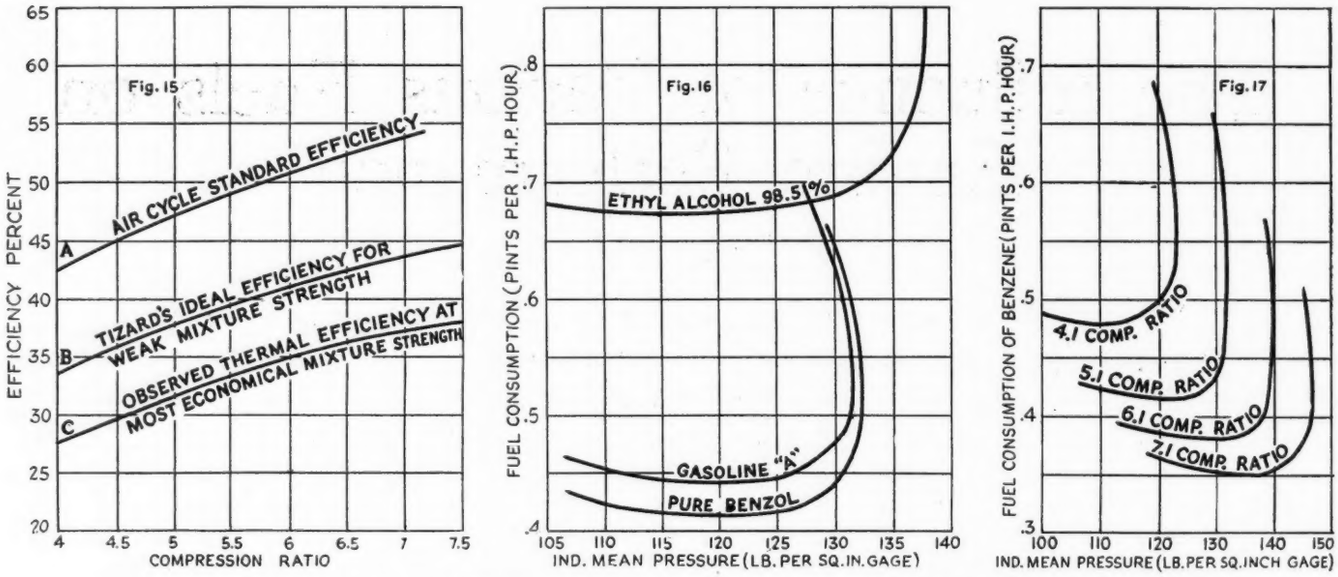



Fig. 15—Relation between thermal efficiency and compression ratio. Fig. 16—Relation between fuel consumption and indicated mean pressure with three different fuels, all used with 5 to 1 compression ratio. Fig. 17—Relation between fuel consumption and indicated mean pressure with benzol at different compression ratios

of the bomb calorimeter, for example, when a sample of liquid fuel is placed in the bomb only a trifling proportion is evaporated before combustion commences. During the process of combustion the remainder of the fuel is evaporated, and the heat required for overcoming the latent heat of evaporation is supplied by combustion. Now when used in an engine the whole, or very nearly the whole, of the fuel is evaporated before the end of the compression stroke, such small proportion as escapes evaporation usually passes through the cylinder unburnt. In practice the proportion of liquid fuel which actually both evaporates and burns during the combustion stroke may be considered as negligible, so that the heat required for evaporation may be regarded as being supplied either outside the cylinder or at least outside the heat cycle. It has been fully accepted by engineers that the latent heat of evaporation of the water formed by the combustion of any hydrocarbon and air should be deducted from the total available heat, because, owing to the high temperature of the cycle, no water is condensed, and consequently this heat cannot be made use of. It is therefore proper and customary to subtract from the total heat the heat equivalent of the evaporation of the water formed. It appears also to be right and proper to add to the total available heat the latent heat of evaporation of the fuel, since this is supplied outside the cycle. To be more strictly accurate there should be added the latent heat at constant volume, which is less than the latent heat at constant pressure by the amount of the work done on the atmosphere if the liquid is vaporized when uninclosed. So far as ordinary gasolines are concerned, the latent heat of evaporation of the fuel bears but a small proportion to its total heat, and does not seriously affect the issue; but in the case of the alcohol group its proportion becomes a very considerable one and should most certainly be taken into account. The most reliable determinations of the calorific value of alcohol, at present available, do not take into account the latent heat of evaporation, and the very high apparent thermal efficiency obtainable with this fuel is therefore largely fictitious.

Theoretical considerations would lead one to suppose that the thermal efficiency, that is to say, the proportion of the total effective heat converted into useful work, should be substantially the same at the same compression ratio for all fuels, with the possible exception of the members of the alcohol group. This is fully borne out by the experiments made. Provided the fuel is vaporized, or that all liquid is sufficiently finely divided and in suspension, the thermal efficiency at any compression ratio is practically constant.

In Table IX the following values are given for each fuel:

Column B.—The lower calorific value according to the accepted standards and the most careful and reliable determinations.

Column C.—The minimum fuel consumption in lb. per I.H.P. hour actually observed with a compression ratio of 5:1 and standard heat input to the carbureter.

Column F.—The "lower" calorific value (Column B) plus the latent heat of evaporation at constant volume.

For all the data given in these articles, except where specifically mentioned, the thermal efficiency has been calculated from the corrected calorific value of the fuel as given in Column F of Table IX, i.e., the calorific value as determined by bomb calorimeter minus the latent heat of evaporation of the water formed, but plus the latent heat of evaporation of the fuel at constant volume.

In the case of the special research engines, the means provided for measuring both the power output and the fuel consumption were such as to insure an accuracy (based on the mean results) of about $\pm$ 0.25 per cent.

It is very doubtful whether the useful calorific of a composite fuel such as gasoline can be ascertained to within closer limits than $\pm$ 0.5 per cent, more particularly when the fuel used is not a chemically pure substance, so that the observed heat value cannot be checked by analysis.

In all tests for power output and efficiency the following procedure was invariably adopted. The engine was run up to speed; the necessary adjustments were made, and a check test was taken on the standard fuel. So soon as the behavior of the engine was ascertained to be entirely normal the fuel was changed, without stopping the engine, to the sample to be examined. The needle valve in the carbureter was then opened until the power output fell slightly, due to over-richness of the mixture and readings of torque, speed and consumption were commenced. The standard jacket temperature, namely, 60 deg. C. (140 deg. Fahr.), and the standard rate of

heat input to the carbureter, namely, 0.0433 B.t.u. per min. per r.p.m. was maintained throughout the test by means of adjustment for each change of mixture strength. The exact number of revolutions during the consumption of a given quantity of fuel was recorded automatically by means of the magnetically operated counter. After each reading the needle valve in the carbureter was closed very slightly, and, after all temperatures had become re-settled, another reading, both of power output and fuel consumption, was taken. This procedure was repeated continuously until the mixture strength became too weak for steady running. Over-weakness was generally indicated first by a tendency to hunt, followed by popping back into the carbureter if the mixture were still further weakened. Such tests were carried out on every sample of fuel examined, and when the quantity available permitted, similar tests were run at different speeds, different jacket temperatures, or different rates of heat input to the carbureter. The results obtained from three of such tests are shown in Fig. 16, giving fuel consumption plotted against the mean pressure for gasoline "A," pure benzol, and for ethyl alcohol 98.5 per cent at a compression ratio of 5:1. Fig. 17 shows similar curves for benzol at different compression ratios, namely, 4, 5, 6 and 7 to 1. It will be seen that the general form and character of the curves so obtained are substantially the same for all the fuels. The differences that do occur are of a small order except in the case of the alcohol group. In the case of alcohol the power continues to rise with increase of mixture strength to an important extent. This is quite certainly due to the increased volumetric efficiency with rich mixtures resulting from the high latent heat of the fuel and the consequent fall in temperature of the charge. The relation between power output and consumption on the weak side is substantially the same for all fuels, but on this side the efficiency obtained depends to a greater extent upon the nature and intensity of the ignition spark and upon its timing. Tests on the weak side were run, both with the ignition set to give maximum efficiency at normal mixture and with the ignition adjusted to suit each reduction in mixture strength. Fig. 18 shows the curves obtained (a) with fixed ignition setting, (b) with the setting adjusted for each change in mixture strength. It was observed that the ignition required to give maximum power on any gasoline with a compression ratio just below its detonation point and between the limits 4.5 to 5.5:1 was 31 deg. before top center at 1500 r.p.m. The ignition could be advanced with advantage when working on the weak side to as much as 45 deg. early on the weakest mixtures. The same applies in the case of all fuels tested. It is interesting also to note that at about the mixture strength giving complete combustion the ignition timing required was very nearly the same for all fuels from heptane to toluene or alcohol.

While the behavior of fuels at mixture strengths weaker than that giving complete combustion is very interesting from a scientific point of view, and highly suggestive of possible developments, yet, so far as the multi-cylinder engine is concerned, it is of but little practical value at present, because, owing to irregularities in distribution, such weak mixtures cannot be used. In every instance where any attempt has been made to supply to a four-cylinder engine a mean mixture strength appreciably weaker than that giving complete combustion, the result has been that one or more cylinders of the group are starved, their ignition becomes irregular, and back firing into the carbureter takes place.

In previous articles, when dealing with the subject of detonation, it has been stated that the tendency to detonate is at a maximum at or about the mixture strength giving maximum economy. This is practically, scientific-

TABLE IX

| Fuel | S.G. at 15° C. (59° Fahr.) | Calorific Value "Lower" (Exclusive of Latent Heat). B.t.u. per Lb. | Minimum Consumption at 5:1 Compn. Lb. per I.h.p. Hr. | Thermal Efficiency from Cols. (C) and (B). Per Cent | Latent Heat at Const. Press. (Atmospheric). B.t.u. per Lb. | Corrected "Lower" Calorific Value. B.t.u. per Lb. | Corrected Thermal Efficiency from Cols. (C) and (F) Per Cent | Minimum Consumption at 5:1 Compression | | Min. Consumption at Highest Useful Compression | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Lb. per I.h.p. Hr. | Pints per I.h.p. Hr. | Lb. per I.h.p. Hr. | Pints per I.h.p. Hr. |
| *Gasolines* | A | B | C | D | E | F | G | H | I | J | K |
| Aromatic free | 0.718 | 19,080 | 0.415* | 32.1 | 133 | 19,200 | 31.9 | 0.415* | 0.462* | 0.422 | 0.471 |
| "A" gasoline | 0.782 | 18,450 | 0.432 | 31.9 | 142 | 18,580 | 31.7 | 0.432 | 0.442 | 0.393 | 0.402 |
| "B" gasoline | 0.723 | 18,890 | 0.423 | 31.9 | 140 | 19,020 | 31.7 | 0.423 | 0.468 | 0.393 | 0.435 |
| "C" gasoline | 0.727 | 19,000 | 0.421 | 31.8 | 135 | 19,120 | 31.6 | 0.421 | 0.463 | 0.410 | 0.451 |
| "D" gasoline | 0.760 | 18,770 | 0.422 | 32.1 | 132 | 18,890 | 31.9 | 0.422 | 0.445 | 0.407 | 0.428 |
| "E" gasoline | 0.719 | 18,970 | 0.421* | 31.9 | 133 | 19,090 | 31.7 | 0.421* | 0.469* | 0.435 | 0.484 |
| "F" gasoline | 0.704 | 19,130 | 0.414 | 32.1 | 134 | 19,250 | 31.9 | 0.414 | 0.471 | 0.412 | 0.469 |
| "H" gasoline | 0.767 | 18,790 | 0.425 | 31.9 | 145 | 18,920 | 31.7 | 0.425 | 0.443 | 0.389 | 0.405 |
| Heavy aromatics | 0.885 | 17,900 | 0.510 | 27.8† | 136 | 18,030 | 27.6† | 0.510 | 0.461 | 0.447 | 0.404 |
| Kerosene | 0.813 | 19,000 | 0.523* | 25.6† | 108 | 19,100 | 25.4† | 0.523* | 0.515* | 0.581 | 0.571 |
| *Paraffin Series* | | | | | | | | | | | |
| Hexane (80%) | 0.685 | 19,250 | 0.411 | 32.2 | 156 | 19,390 | 32.0 | 0.411 | 0.480 | 0.405 | 0.473 |
| Heptane (pure) | 0.691 | 19,300 | 0.410* | 32.1 | 133 | 19,420 | 31.9 | 0.410* | 0.475* | 0.491 | 0.568 |
| *Aromatic Series* | | | | | | | | | | | |
| Benzol (98%) | 0.884 | 17,300 | 0.458 | 32.1 | 172 | 17,460 | 31.8 | 0.458 | 0.415 | 0.392 | 0.355 |
| Toluene (99%) | 0.870 | 17,520 | 0.455 | 31.9 | 151 | 17,660 | 31.7 | 0.455 | 0.418 | 0.385 | 0.354 |
| Xylene (91%) | 0.862 | 17,800 | 0.452 | 31.6 | 145 | 17,930 | 31.4 | 0.452 | 0.420 | 0.381 | 0.354 |
| *Naphthene Series* | | | | | | | | | | | |
| Cyclohexane (93%) | 0.786 | 18,800 | 0.420 | 32.1 | 156 | 18,940 | 31.9 | 0.420 | 0.427 | 0.385 | 0.392 |
| Hexahydrotoluene (78%) | 0.780 | 18,760 | 0.425 | 31.9 | 138 | 18,890 | 31.7 | 0.425 | 0.436 | 0.394 | 0.404 |
| Hexahydroxylene (60%) | 0.744 | 18,770 | 0.424* | 32.0 | 133 | 18,890 | 31.8 | 0.424* | 0.456* | 0.429 | 0.461 |
| *Olefine Series* | | | | | | | | | | | |
| Cracked spirit (53% unsat.) | 0.757 | 18,400§ | 0.429 | 32.3 | 150§ | 18,540 | 32.0 | 0.429 | 0.453 | 0.405 | 0.428 |
| *Alcohol Group* | | | | | | | | | | | |
| Ethyl alcohol (98.5%) | 0.798 | 11,470 | 0.663 | 33.5 | 406 | 11,840 | 32.4 | 0.663 | 0.665 | 0.532 | 0.533 |
| Ethyl alcohol (95 vol. %) | 0.815 | 10,790 | 0.705 | 33.5 | 442 | 11,130 | 32.5 | 0.705 | 0.692 | 0.565 | 0.555 |
| Methyl alcohol (purified wood naphtha) | 0.829 | 9,630 | 0.777 | 34.0 | 500§ | 10,030 | 32.7 | 0.777 | 0.750 | 0.725 | 0.700 |
| Methylated spirits | 0.821 | 10,200‡ | 0.740 | 33.7 | 450§ | 10,580 | 32.5 | 0.740 | 0.721 | 0.625 | 0.609 |

*This sign indicates that at a compression ratio of 5:1 the fuel could not be used owing to detonation. These values for fuel consumption are therefore calculated from the readings obtained from tests made with lower compressions. The close agreement between thermal efficiencies calculated from these results clearly shows the uniformity of the relation between compression ratio and thermal efficiency for the different fuels tested.

†The low thermal efficiency observed for those fuels is quite certainly due to non-combustion of a portion of the fuel which probably remains liquid during the working stroke.

‡The calculated heat value for methylated spirits was given in Part I of these articles as 9,850 under a misapprehension as to the water content. The value now given, namely, 10,200 B.t.u. per lb., is probably nearly correct for the ordinary purple variety of this specific gravity.

§Approximate.

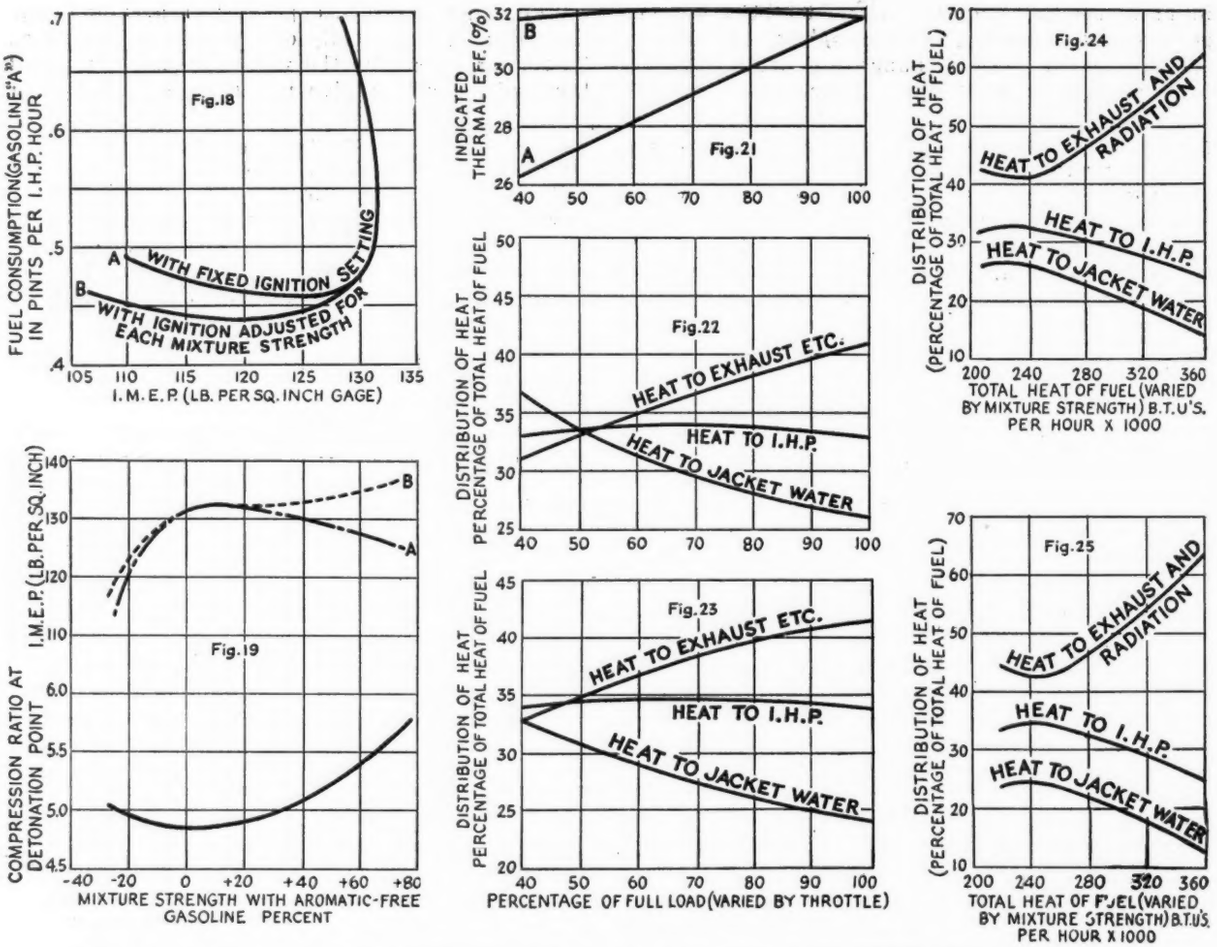


Fig.18
FUEL CONSUMPTION (GASOLINE "A") IN PINTS PER I.H.P. HOUR
A WITH FIXED IGNITION SETTING
B WITH IGNITION ADJUSTED FOR EACH MIXTURE STRENGTH
I.M.E.P. (LB. PER SQ. INCH GAGE)
Fig.19
I.M.E.P. (LB. PER SQ. INCH)
COMPRESSION RATIO AT DETONATION POINT
MIXTURE STRENGTH WITH AROMATIC-FREE GASOLINE PERCENT
Fig.21
INDICATED THERMAL EFF. (%)
Fig.22
DISTRIBUTION OF HEAT PERCENTAGE OF TOTAL HEAT OF FUEL
HEAT TO EXHAUST ETC.
HEAT TO I.H.P.
HEAT TO JACKET WATER
Fig.23
PERCENTAGE OF FULL LOAD (VARIED BY THROTTLE)
Fig.24
DISTRIBUTION OF HEAT (PERCENTAGE OF TOTAL HEAT OF FUEL)
HEAT TO EXHAUST AND RADIATION
TOTAL HEAT OF FUEL (VARIED BY MIXTURE STRENGTH) B.T.U'S. PER HOUR X 1000
Fig.25

Fig. 18—Effect of spark timing upon relation between fuel consumption and indicated mean pressure. Fig. 19—Effect of mixture strength on indicated mean pressure and allowable compression ratio. Spark adjusted to give maximum power in each case. Fig. 21—Relation between indicated thermal efficiency and load, (a) with fixed ignition, (b) with ignition adjusted for maximum efficiency. Fig. 22—Heat distribution at various loads. Gasoline "A", Compression ratio 5.45 to 1, constant speed and uniform heat input, jacket temperature, etc. Fig. 23—Heat distribution at various loads, using alcohol as fuel, other conditions same as for Fig. 22. Fig. 24—Heat distribution at different mixture strengths on gasoline "A", 5.45 to 1 compression ratio. Fig. 25—Heat distribution at different mixture strengths on 95 percent alcohol, 5.45 to 1 compression ratio

ally true. Strictly speaking, the tendency to detonate is at a maximum at or about the mixture strength giving complete combustion, and this in practice is almost coincident with that giving maximum economy. With the very weak mixtures a rather higher compression can be used without detonation, but under such a condition an engine is working between exceedingly narrow limits of mixture strength. Satisfactory running would be quite unattainable with an ordinary carbureter even on a single-cylinder engine. In any multi-cylinder engine to work within such limits of mixture strength is certainly far outside practical possibility. With a view to investigating this point more thoroughly a careful series of tests was made on the standard aromatic free gasoline over a range of mixture strengths from 75 per cent rich to 25 per cent weak. After each adjustment of mixture strength the compression ratio was varied so that detonation was just audible. The results of this interesting test are shown in the curves, Fig. 19. It will be seen that with any mixture strength between 10 per cent rich to 10 per cent weak the available compression ratio was 4.85:1. When the mixture was varied in either direction beyond these limits it became possible to raise the compression without causing detonation. The full line curve shows that when the mixture was 20 per cent weak the compression could be raised to 4.95:1, and with a mixture strength 75 per cent rich the compression could be increased to 5.75:1. The ignition setting was adjusted to give maximum power for each condition. In the same figure is shown (a) the variation in m.e.p. over the same range of mixture strength at a constant compression ratio of 4.85:1, and with ignition timing adjusted to suit each mixture strength; and (b) the same again, but with compression ratio adjusted as permitted by each change of mixture strength. From these curves it will be seen that only a very slight increase in compression ratio can be obtained with weak mixtures, and then only when the mixture is so weak that the running is become unstable.

### Influence of Jacket Water Temperature

While all standard tests were run with a jacket water temperature of 60 deg. C. (140 deg. Fahr.), some series of tests were also run at temperatures of 35 deg. C. (95 deg. Fahr.) and 85 deg. C. (185 deg. Fahr.). In the case of all fuels boiling below about 180 deg. C. (356 deg. Fahr.) the water temperatures did not influence the efficiency to any appreciable extent, though in some cases, notably with the more volatile fuels, a very slight gain in efficiency was observed when the water temperature was at its lowest, due probably to the general reduction in the temperature of the cycle. The difference was, however, exceedingly small, and for all practical purposes may be regarded as insignificant. It must be understood that these remarks refer to the indicated thermal efficiency. So far as the brake thermal efficiency is concerned, any increase in temperature of the cylinder

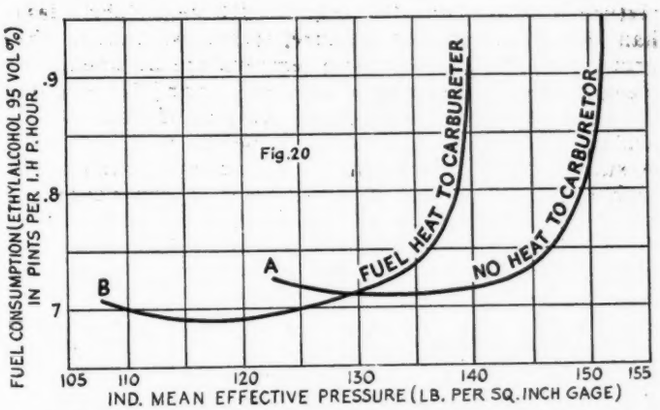



Fig. 20—Effect of heating the charge on the relation between fuel consumption and indicated mean pressure.

walls results in a decrease in piston friction due to the lower viscosity of the lubricating oil. The gain in mechanical efficiency due to reduced friction losses with higher jacket temperatures generally more than outweighs any difference in indicated thermal efficiency. Since pistol friction is purely a mechanical factor and varies widely in different engines, it is thought best to deal only with the indicated performance. In both the variable compression and the supercharging engines on which these tests were made the piston friction is so low that the brake thermal efficiency was virtually unaffected by changes in the temperature of the cooling water.

### Influence of Heat Input to the Carbureter

In all the standard tests a uniform rate of heat input of 0.0433 B.t.u. per minute per r.p.m., or 65 B.t.u. per minute at 1500 r.p.m., was supplied. Other series were also made with no heat input to the carbureter, and also with a heat input of 0.066 B.t.u. per minute r.p.m.

So far as the more volatile fuels are concerned, that is, fuels boiling below 180 deg. C. (356 deg. Fahr.), the heat input, while affecting the power very adversely by reducing the weight of charge entering the cylinder, had no influence upon the thermal efficiency except in so far as a high rate of heat increased the tendency to detonate, and so necessitated the use of a lower compression ratio. The effect of heat input to the carbureter and of water jacket temperature when running with a mixed fuel having an abnormally wide range of boiling, will be dealt with later, but the above remarks must be regarded as applicable to reasonably volatile and homogeneous fuels such as the various gasolines given in the tables, also the lighter aromatics and naphthenes. In the case of 95 volume per cent ethyl alcohol the efficiency rose from 31.6 per cent to 32.5 per cent, when the heat input was raised from nil to 0.066 B.t.u. per minute per r.p.m. In view of the behavior of most of the gasolines which have very much higher final boiling points, this feature is perhaps a little curious; but alcohol, owing to its higher latent heat, its considerable water content, and its low vapor tension, behaves somewhat differently from most of the other fuels tested. Fig. 20 shows the M.E.P. and fuel consumption obtained with 95 volume per cent ethyl alcohol, curve (a) with no heat input, and curve (b) with a heat input of 0.066 B.t.u. per minute per r.p.m. It will be seen from these curves that the minimum fuel consumption is appreciably lower under the heated condition. The maximum power output, of course, is very much lower. From tests on multiple-cylinder engines on gasoline, benzol, etc., where the problem of distribution enters into the account, it was found that a very considerable heat input was required in order to obtain the best thermal efficiency. The heat required varied considerably for different engines; the amount may be taken as an inverse measure of the efficiency or otherwise of the distribution system.

### Efficiency on Reduced Loads

When the load on an engine is reduced by throttling the supply of working fluid, and the mixture strength is maintained the same as for full load, the temperatures in the heat cycle will be substantially the same, since neither the ratio of compression nor the heat of combustion of the mixture are altered. The only condition which is changed appreciably is the proportion which the residual exhaust products bear to the whole of the working fluid. Apart from the latter consideration the efficiency of the cycle should remain very nearly the same at all throttle openings. Experiments with the time of ignition fixed at that giving maximum efficiency on full throttle have shown that, as the throttle is closed and the power output is reduced at constant speed and constant mixture strength, the efficiency falls; but when the ignition is readjusted to give maximum efficiency at each throttle opening, the indicated thermal efficiency remains substantially constant over a wide range of load, e.g., from 40 per cent to 100 per cent. Fig. 21 shows (a) the indicated thermal efficiency observed on petrol with a constant mixture strength and fixed ignition setting, and (b) the indicated thermal efficiency with the ignition adjusted at each load to give maximum efficiency. It will be observed in the case of curve (b) that the efficiency at about 70 per cent full load is actually appreciably greater than that obtainable on full loads. This characteristic is not peculiar to gasoline, but has been observed also with alcohol. Very great care was taken to ascertain carefully the variation in pumping losses at the different throttle openings, and to correct for such variation when computing the indicated power or efficiency. It would appear that the presence of a greater proportion of exhaust products on reduced loads influences appreciably the rate of burning of the mixture, and therefore necessitates an earlier ignition timing.

Fig. 22 shows the variation in heat distribution for gasoline "A" with different loads at a constant speed of 1500 r.p.m. and under uniform conditions as to heat input, jacket temperature, etc.

Fig. 23 shows a similar set of curves for 95 volume per cent alcohol under identical conditions. In both cases the heat input to the carbureter was proportional to the load and equivalent to 65 B.t.u. per minute at full load.

### Efficiency on Alcohol

While at any given compression ratio the thermal efficiency was found to be the same on all volatile hydrocarbon fuels, the efficiency obtained with alcohol was consistently higher. For the samples of ethyl alcohol and for a sample of methylic alcohol (purified wood naphtha) accurate calorific values were obtained. These determinations were made by The Asiatic Petroleum Co. at their central testing laboratory at Shell Haven. The determination made of the heat value of 98.5 per cent ethyl alcohol agreed with the value given by Richards to within 0.25 per cent. The values for the alcohol are given in Columns B and F of Table IX. Very careful tests were run with 95 volume per cent ethyl alcohol at compression ratios of 3.8:1, 5:1 and 7:1 under exactly similar conditions as to speed, jacket temperature and rate of heat input to the carbureter. The distribution of heat to the jackets and to the exhaust was very carefully determined also. Similar tests were run also on several gasolines (within the limits of useful compres-

sion ratio) and on benzol. The results obtained are shown in Table X.

TABLE X

| A Compression Ratio | B Ind. Therm. Efficiency, Alcohol 95 Vol. % | C Ind. Therm. Efficiency, Hydro-Carbons | D Relative Efficiency, Alcohol 95 Vol. % | E Relative Efficiency, Hydro-Carbons |
|---|---|---|---|---|
| 3.8 :1 | 26.8 | 26.3 | 65.0 | 63.7 |
| 5.0 :1 | 32.5 | 31.7 | 68.5 | 66.8 |
| 7.0 :1 | 38.2 | 37.4 | 70.7 | 69.3 |

From this table it will be observed that the thermal efficiency obtained with ethyl alcohol at all compression ratios was some 2½ per cent higher than that obtainable with hydrocarbon fuels, when the calorific values in all cases are subjected to the same corrections for the latent heat of evaporation. The explanation of this gain in efficiency is to be found in the reduction in the temperature of the cycle due to the evaporation of the alcohol within the cylinder. In all cases the heat input to the carbureter at 1500 r.p.m. was at the rate of 65 B.t.u. per minute.

TABLE XI

| Fuel | Total Heat of Fuel, B.t.u. per Hr. | Heat to I.h.p., B.t.u. per Hr. | Heat to Jacket Water, B.t.u. per Hr. | Heat to Exhaust, Etc., B.t.u. per Hr. |
|---|---|---|---|---|
| Gasoline ..... | 253,000 | 66,800 | 72,400 | 113,800 |
| Alcohol, 95 vol. %.. | 275,000 | 73,900 | 67,200 | 133,900 |

In the last article it was shown that the drop in temperature of the working fluid due to the evaporation of the liquid fuel was, in the case of gasoline "A," 20 deg. C. (68 deg. Fahr.), and in the case of ethyl alcohol 98 per cent., 85 deg. C. (185 deg. Fahr.), while in the case of 95 per cent volume it would, owing to the high water content, be equivalent to 97 deg. C. (207 deg. Fahr.). There appears to be no doubt that practically the whole of the fuel and the water contained in it evaporates completely either during entry to the cylinder, or, at any rate, before the completion of the compression stroke; it is clear, therefore, that the temperature at the end of compression will, in the case of alcohol, be some 70 deg. C. (158 deg. Fahr.) lower than in the case of gasoline. Since the maximum flame temperature of an alcohol mixture is also about 100 deg. C (212 deg. Fahr.) less than that of a gasoline mixture, it follows that in the former case the highest flame temperature attained will be approximately 170 deg. C (338 deg. Fahr.) lower than that of a gasoline mixture, and the loss of heat to the jackets and that due to change of specific heat, etc., will be substantially reduced. Again, when running with alcohol, the total weight of working fluid passing through the cylinder is greater as explained previously, hence the relative loss of heat will be even slightly less than would appear from a consideration of the temperatures alone.

Table XI shows the heat distribution observed when running with gasoline "A" and with 95 volume per cent ethyl alcohol with a compression ratio, in this instance, of 3.8:1. The mixture strength both for the gasoline and for the alcohol was that giving maximum efficiency. From a comparison of the proportionate heat loss to the cylinder cooling water, it will be observed that the amount of heat given up to the cylinder walls is considerably greater in the case of gasoline than alcohol, indicating again a considerably higher cycle temperature.

Figs. 24 and 25 show respectively the observed variation in the distribution of heat (to indicated work, to cooling water, and to exhaust) with different mixture strengths on gasoline and alcohol in both cases at a compression ratio of 5.45:1. The horizontal scale denotes the total number of B.t.u. per hour supplied to the engine, and the vertical scale the percentage accounted for in i.h.p. and cooling water. The upper curve is plotted by difference, and represents the heat rejected in the exhaust and by radiation.

Table IX gives the observed minimum fuel consumptions in lb. and in pints per indicated horsepower hour. Columns H and I show the consumptions for a fixed compression ratio of 5:1. Columns J and K give the minimum fuel consumption obtained when running the engine with the highest useful compression ratio for each fuel.

# Strength of Screw Fastenings in Plywood

IF the screw fastenings in plywood construction are to be as strong as the plywood itself, it is important to adapt the size of screw, spacing, and margin to the particular species and thickness of plywood used. Tests made at the Forest Products Laboratory have shown that the commonly-used plywood species may be divided into the following groups, all woods in any one group requiring the same screw fastening to develop maximum strength.

| | GROUP I—*Low Density* | |
|---|---|---|
| Basswood | Douglas fir | Pine, white |
| Cedar, Spanish | Fir, true | Poplar, yellow |
| Cottonwood | Hemlock | Redwood |
| Cypress, bald | Pine, sugar | Spruce, Sitka |
| | GROUP II—*Medium Density* | |
| Ash, black | Gum, cotton | Mahogany |
| Ash, pumpkin | Gum, red | Maple, soft |
| Elm, white | Hackberry | Sycamore |
| Gum, black | Magnolia | Walnut, black |
| | GROUP III—*High Density* | |
| Ash, white | Birch | Elm, cork |
| Beech | Cherry, black | Maple, hard |

The screw sizes, margin, and spacing for use with each species and plywood thickness will be found in the following table. The gage is the smallest that can be used with the thickness specified and not cause failure through breaking of the screw when the full strength of the plywood is developed. The length of screw is the shortest which will prevent the screw from pulling out before the full plywood strength is reached. The margin is the smallest distance from edge of hole to edge of plywood which will insure against failure by shear. The spacing is the distance from center to center of screw holes which gave maximum strength per linear inch.

SIZE AND SPACING OF SCREWS FOR MAXIMUM STRENGTH IN PLYWOOD

| Species of Plywood | Thickness of Plywood in Inches | Gage (Number) of Screw | Screw Length in Inches, Species Receiving Point: White Ash | Screw Length in Inches, Species Receiving Point: Spruce | Margin in Inches | Spacing in Inches |
|---|---|---|---|---|---|---|
| Group I | 3/30 | 4 | ½ | 5/8 | ½ | ¾ |
| | 3/24 | 5 | ½ | 5/8 | 5/8 | ½ |
| | 3/20 | 6 | 5/8 | ¾ | 5/8 | ½ |
| | 3/16 | 7 | 5/8 | ¾ | 5/8 | 5/8 |
| | 3/10 | 9 | ¾ | 1 | ¾ | ¾ |
| | 3/8 | 11 | 1 | 1¼ | ¾ | ¾ |
| Group II | 3/30 | 5 | ½ | 5/8 | ½ | ½ |
| | 3/24 | 6 | 5/8 | ¾ | 5/8 | ½ |
| | 3/20 | 7 | ¾ | ⅞ | 5/8 | 5/8 |
| | 3/16 | 8 | ⅞ | 1 | 5/8 | ¾ |
| | 3/10 | 10 | 1 | 1¼ | ¾ | ¾ |
| | 3/8 | 12 | 1¼ | 1½ | ¾ | ⅞ |
| Group III | 3/30 | 6 | 5/8 | ¾ | ½ | ½ |
| | 3/24 | 7 | ¾ | 1 | 5/8 | 5/8 |
| | 3/20 | 8 | 1 | 1¼ | 5/8 | ¾ |
| | 3/16 | 9 | 1¼ | 1½ | 5/8 | ¾ |
| | 3/10 | 11 | 1½ | 1¾ | ¾ | ⅞ |
| | 3/8 | 13 | 1¾ | 2 | ¾ | 1 |

About equally good results were obtained with flat-headed screws without washers and round-headed screws with washers. Round-headed screws without washers proved an inferior means of fastening. The spacing given in the table is for screws in a single row, but staggering is recommended wherever possible.

# The Specification and Testing of Castings

**Every engineer is aware of the difficulty of satisfactorily testing castings. Various methods are used, but each is subject to certain defects. Dr. Rosenhain analyzes here the different methods, points out their merits and deficiencies, and indicates the best practice under present conditions.**

By Dr. Walter Rosenhain, F.R.S.

CASTINGS play an important part in all automobile construction and it is correspondingly important that satisfactory methods of making tests and drawing up specifications should be arrived at. Yet there can be no doubt that it is a much more difficult matter to deal with castings in this respect than with other materials of construction. The reason is that the physical properties of metal which has undergone forging and rolling operations are rendered, to a considerable extent, uniform thereby, minor inequalities which may have existed in the ingot or slab being more or less "smoothed out."

It is true, of course, that no amount of hot or cold working will make really sound metal out of an unsound or segregated ingot, but enough is known about the nature of ingots or slabs to make it possible, by reasonable supervision, coupled with sound practice, to eliminate the grosser defects and differences, and minor differences only affect the properties of the final wrought product to a secondary degree.

It is quite different with an actual casting. In nearly all metals the physical properties depend to a very large extent upon the rate of solidification and cooling, so that the temperature of the metal at the time of pouring the casting, the temperature (or dryness) of the mold and its heat capacity, as well as the mass of the casting or of any particular portion of it, all affect the properties of the resulting piece. There are other factors also—dependent upon the design of the casting and the manner in which it is molded—which bring with them differences in the degree of soundness in different parts of the same casting. Taking all these factors together, it would seem that it is no easy or simple matter to state what is the "strength" of a given casting, even when the conditions under which it is made are carefully considered.

Some experiments to test this point have been carried out under the auspices of the British Aircraft Inspection Directorate of the Air Ministry, who took several crankcases cast in aluminum alloys for aeroplane engines, cut them up and prepared a number of test pieces from various parts of the same casting so as to represent portions of varying thickness. Very great variations in tensile strength were found; as a rule, test pieces cut from the thinner portions proved to be much stronger than those cut from the thicker portions, but the relative position in the casting of the test piece and the "gates" and "risers" was also of importance. It may be that these differences are particularly well marked in aluminum alloys, but there is every reason to believe that the same results would be obtained with castings made of other metals. Further, if in a sand-casting, for instance, local chills were introduced with a view to affecting the rates of cooling of different portions, the effect on the resulting tensile properties of test pieces cut from various portions of the casting would be still more marked.

If we face the facts squarely, then, we must admit that the material of any given casting does not possess any definite "strength" or even "tensile strength." How, then, are we to test our castings and how specify their strength? Various methods have been adopted and are more or less strongly advocated, and it will be worth while to examine them somewhat closely in order to arrive at a reasoned answer to our question.

### Testing Whole Casting

An obvious first suggestion is to test the casting as a whole in some well-defined manner, much in the way in which a railway tire is tested by placing it under the drop-hammer. With castings of complex shape, however, this is a difficult matter. It is, first of all, rarely possible to carry out such a test except under compression, and the compression properties of a casting are by no means necessarily representative of its tensile properties or of its "strength" generally.

Then, too, there is the difficulty of securing any reasonable degree of accuracy in a test upon a body of irregular shape. Slight variations in the position of the casting during the test, and, still more, slight variations in the thickness of the casting at the most heavily stressed point, are liable to bring with them variations greater than those which would normally be found as between a "good" and a "bad" casting of the same nominal metal.

Indeed, were the method of testing in this way once specified, it would be quite an easy matter for the founder —if he so wished—to thicken the casting slightly in the right place in such a way as to make it stand up to that particular test. Since the test can scarcely be made to correspond to real service conditions, the result might be anything but satisfactory so far as the real usefulness of the casting is concerned.

### Test Pieces and Bars

The next method to be discussed is one which has been widely used for certain purposes; it consists in making tests on test pieces cut out of definite places in actual castings. It shares with the previous method the serious disadvantage that a certain number of apparently good castings are destroyed for testing purposes, and, where large and complicated castings are concerned, this would be a serious matter. Nor is the cost of such a proceeding counterbalanced by any real advantage. If the portion of the casting to be used for the test is specified beforehand, it is a comparatively easy matter for the foundryman to make sure that this particular portion of the casting is entirely satisfactory. Quite apart from difficulties of that kind, however, such a test piece will

not, in the ordinary way, be truly representative of the casting as a whole; it may show too high or too low a strength, according to the kind of part from which it has been cut.

The third and most widely used and advocated method consists in specifying that one or more "test bars" shall be molded along with the casting and connected to it in a suitable runner, so that these bars are cast together with the main casting. The advocates of this method suggest that in such "cast on" test bars we have, substantially, a portion of the main casting itself, cast under the same conditions and in the same kind of mold, but always of a standard thickness, so that the effects of variations in the rate of cooling do not occur. This looks satisfactory at first sight, but there are difficulties about it.

The first of these is that there is no certainty whatever that the bars are really cast under the same conditions as the main castings. It is true that they are poured with the same metal and at the same temperature. On the other hand, the founder, in his own interests, will and must take care that these bars turn out as sound and strong as possible, and it does not follow, therefore, that the conditions of feeding, etc., will be the same for the test bars as for the casting to which they are attached.

Cases have been known where the test bars were so placed that during solidification the test bars were fed by metal drawn from the rest of the casting, which thus actually suffered "drawing" for their benefit. Nor need such an occurrence be the result of any intentional action on the part of the founder; it may easily occur without his knowledge or desire, and it is not, therefore, to be regarded as a difficulty of the same order as that which would arise if the test bars were "helped" by the insertion of suitable chills into the mold. Yet even if all these pitfalls be avoided, the "cast on" test bar is not a true index of the strength of any part of the casting itself, since the effects of drawing, contraction stresses, etc., are all more or less completely eliminated in the case of the bars, while they play a most important part in the main casting.

### Determining Metal Quality

If we feel obliged to admit the force of these destructive criticisms of the three methods of testing castings which we have so far discussed, what possibility remains open to us? The answer is that, although it is more or less futile to endeavor to obtain tests representing the strength of actual castings, it is possible and desirable to obtain tests representative of the quality of the metal of which the casting has been made.

If we are satisfied that the metal was right in composition, temperature, etc., and inspection shows that the casting is a good one—sound and free from "drawing"—then we can be sure that the strength of the casting will be as good as the material in question can yield. If one thinks of it carefully, no test can really establish more than this, unless it is one which can be applied to every casting without causing destruction. Our problem, then, resolves itself into devising a means whereby the quality and condition of the metal from which any casting has been poured can be satisfactorily tested. This is a relatively simple problem, since it is only necessary to have a sample of the metal poured into some standard mold immediately before and, preferably, also immediately after the main casting is poured.

It may perhaps be urged that the "cast on" test bar constitutes the simplest and safest way of doing this, but certain objections to the "cast on" bar have already been mentioned. Beyond these, however, there is this very serious one, that "cast on" bars have nearly always to be cast in a sand mold, and it is by no means easy to standardize a sand mold to a satisfactory extent. Small differences of ramming, venting, gating, etc., make large differences to the resulting bar. All these objections are removed if the test bars are cast in separate small chill molds. These can easily be made and kept to a closely defined standard, nor can they be in any way tampered with or altered in such a way as to give a "better" result than the metal deserves.

These considerations do not, perhaps, apply to cast iron, in which material a chill cast bar would obviously be quite unsuited for testing and entirely out of relation with any casting molded in sand. For other metals, however, and particularly for aluminum alloy castings, with which the automobile engineer is deeply concerned, it may safely be said that the results obtained with a bar cast in a chill mold 1 in. in diameter and from 9 to 12 in. high are a good approximation to the best results which can be obtained from cast material without heat-treatment.

### Weakness of Test Bar Method

It is this very consideration, that the separately cast chill test bar gives the best value obtainable with the alloy, which is both the great strength and—in one sense—the weakness of this method of testing and specifying the strength of cast material. Its strength lies, as already indicated, in its easy standardization and in the practical impossibility of improving, by any ordinary device, upon the results which the straightforward use of the chill will give.

The test thus furnishes the clearest and most definite measure of the quality of the actual material used in the production of the casting. The weakness of the method—such as it is—lies in the fact that the strength found in the chill-cast test bar is not even approximately the same as that of the actual casting. It is sometimes suggested that the appearance, in the specification, of the high tensile test figure which the chill-cast test piece must produce is apt to mislead the designer and to give him the impression that the material is much stronger than is in reality the case. This is, surely, an aspersion on the intelligence of the designer, who must know enough of his materials to appreciate the difference between a standard chilled bar and the various portions of a casting molded in sand, with or without the introduction of local chills.

Provided that such unintelligent misinterpretation of specifications need not be considered seriously, the value of the test figure from a chill-cast test piece is at least as great as that from any other test piece that can be used. None of them, as we have seen, can be taken by itself to represent the real strength of the casting, and the only sound method of handling the problem is to correlate the actual strengths found by a few preliminary tests on pieces cut from various parts of a casting with the results of a standardized test made upon the metal at the same time. Once such correlation has been obtained, and provided that the inspection of the castings is carefully carried out so as to insure the absence, at least, of visible unsoundness and drawing, then the data obtained from current tests on a standard chill-cast bar can be safely used as a guide to the quality of the metal used and, therefore, of the castings themselves. It is, at all events, a sounder guide than can be obtained from test results of pieces produced in a less standardized and more readily varied manner.

### Accessory Tests

While the whole problem of the testing and specification of castings is thus a difficult one, there are certain

accessory tests which can be usefully employed. These are the ordinary "hardness" tests by means either of the Shore scleroscope or some modification of the Brinell ball-indentation test. By either of these methods it is possible to make tests, if desired, upon definite parts of every single casting.

By itself such a test could scarcely be regarded as adequate, since the correlation between tensile strength and Brinell or scleroscope number is not very reliable in aluminum alloy castings unless very careful control of the chemical composition is at the same time maintained. But as an adjunct to the system of testing by means of standard chill-cast tensile test bars, these hardness tests are particularly valuable. They can be made in such a manner as not to affect the usefulness or the appearance of the casting, and they can be made rapidly and, therefore, cheaply. Their utility lies mainly in serving as a test of uniformity of quality, but correlation with the tensile properties, both of the casting itself and of the test bar, is perfectly possible for any given alloy and type of casting.

Apart from the purely mechanical tests which have been discussed above, a number of other problems arise, particularly in connection with aluminum alloy castings. For certain purposes, particularly pistons and cylinders of engines, porosity is regarded as dangerous and tests are often specified to guard against such a defect. This generally takes the form of a test under hydraulic pressure of moderate severity—200 to 300 lb. per square inch, and the casting is required not to "sweat" under this test. If it does, the question arises whether any form of "stopping" or "doping" shall be permitted. Under war conditions British practice permitted "doping" with solutions of silicate of soda in the case of all castings other than pistons, but it is very doubtful whether such treatment is not unduly risky for other than war purposes. It is certainly a thing to be avoided if at all possible, and recent progress in the casting of aluminum alloys suggests that aluminum founders should be perfectly able, under normal conditions, to produce castings which do not require "doping." They may cost a little more—on account of occasional rejections—but the automobile engineer is well justified in insisting upon having them.

While insisting upon having his castings sound, nonporous and free from "drawing," the engineer should not attach undue importance to one feature which is frequently found in aluminum alloy castings. This consists of numerous very small spherical holes which can be seen on most of the machined surfaces of such castings. These appear to be due to very minute gas bubbles liberated at the moment of solidification. If one watches the surface of the molten alloy just prior to solidification, it behaves rather like the surface of very weak soda-water—minute bubbles rise and burst or remain on the surface—there is, indeed, a very mild kind of effervescence. Very great care in melting the metal is required to reduce or eliminate these minute bubbles, but fortunately they do not appear to be seriously harmful. The writer has repeatedly found that test pieces giving exceptionally good results were apparently full of these bubbles, while others, nearly or quite free from them, gave lower results. They are not, of course, a desirable feature, but they do not indicate real porosity and it would be unwise to reject a casting on their account if they are not unduly large.

While the remarks in the last few paragraphs of this article have been devoted specifically to aluminum alloys, most of the general considerations put forward apply to castings in most metals, although cast iron presents problems of its own. Enough has been said, however, to suggest that the specification and testing of castings is a matter which requires careful consideration. Under war conditions it has received this consideration in England, and the method of the separate chill-cast test piece has been adopted very widely. In American practice this is not the case, and for that reason it has, perhaps, been worth while to set forth the whole case, as fairly as possible, here.

# A Four-Valve Motorcycle Engine

**RICARDO has designed for the British motorcycle maker with the largest output (Triumph), a four-valve single cylinder engine for use in the recent Isle of Man motorcycle road races. The new engine has the valves in pairs at 90° in a detachable cast iron cylinder head. They are operated by a pair of push rods. A separate pocket and pipe is provided for each exhaust valve, but the inlet valves have a single pipe and port. A machined steel cylinder with horizontal ribs is used and is held to the aluminum crank case by four set screws in steel bushes. The head is secured to the cylinder by four long bolts passing down through the double bottom rib. Pistons are of the slipper type in aluminum with two narrow rings.**

**The inlet valves are of the Ricardo masked type having their seatings recessed in the valve pocket, so that a quick effective opening and cut-off is secured, with a comparatively gradual initial and final movement, from and to the seat respectively.**

**This new engine is not yet standardized, has not, in fact, yet passed the experimental stage; but it is intended eventually for the Triumph standard machines, displacing the 550 c. c. 4 h.p. side valve engine used for some years past. Its bore and stroke are 80.5 x 98 mm. and it is designed to run up to 5000 r.p.m. The peak of its power curve reaches 20 b.h.p., admittedly a remarkably high output for a single cylinder of this size.**

**The B. S. A. Company also put up a special overhead two-valve engine for the Isle of Man (Tourist Trophy) Races. This, too, has a single cylinder and a peculiar feature of the valve system is the adoption of "knife edge" bearings for the overhead rockers.**

# New Make of Laminated Wood Disk Wheel

A VEHICLE wheel in which a disk of laminated wood takes the place of the usual spokes has recently been developed. The wheels are made from the same grades of wood as used for airplane propellers and are laminated in such a way that the grain in each lamination runs in a different direction from the grain of the other laminations.

These wheels are claimed to be of about the same weight as spoked wheels but to have four times the lateral strength. Tire inflation does not involve any unusual difficulties with this wheel, the air tube being attached to the outside of the wheel. The air valve pocket has a flat cover front and back, so there is no projecting part to be knocked off and no open pocket to catch dirt. No spare wheel needs to be carried, only a spare rim with tire. The wheel is manufactured by George W. Smith & Co., Inc.

# Machining an Eight-Cylinder Crankcase

**A production of 20 engines per hour is maintained in the new engine plant discussed here. Machining the crankcase presents problems in the construction of jigs and fixtures. Many special machines are used to produce this eight-cylinder, V-type aluminum crankcase.**

By J. Edward Schipper

MANUFACTURE of the crankcase for an eight-cylinder engine entails some very interesting production problems on account of the V-construction. In order to have the proper angle between the blocks, the landing faces for the cylinder flanges are, of course, at a complementary angle. Some difficult manufacturing problems must be solved, particularly in the way of jig and fixture construction, in order to perform simultaneous drilling and other machining operations.

The new Oldsmobile engine plant, which has been completely tooled and equipped for the manufacture of the small, eight-cylinder engines, is arranged for a production of about 20 engines per hr. The operations on the different machines are all timed for about this pace, and the machine tool equipment is very closely balanced so that practically all of the machines are in operation during the entire 9-hr. working day to maintain a smooth flow of manufacture. The crankcase material is aluminum and of orthodox construction.

The finished crankcase is shown in Fig. 1, receiving its final inspection. This finished view of the case will give an accurate idea of the machining problems required for its manufacture. As will be noted, it is a unit powerplant type of case and has the camshaft centrally located above the crankshaft, as is customary in eight-cylinder, V-practice.

The crankcases are first checked over to determine if there is sufficient metal for all machining cuts. The locating points are checked at the foundry. There are three locating points, two supporting arms and the boss for the oil line, which runs to the front camshaft bearing. These same locating points are used for the first manufacturing operation, which consists of milling the oil pan or bottom face of the crankcase. This work is done on an Ingersoll miller with a rotary table. The machine holds five cases and gives both a rough and finish cut. There are three cutters, two being for the rough cut and one for the finish cut. The cases are secured to the table by clamps which hold the supporting arms of the case and location is fixed by stops at the points described. The machine readily takes care of 20 crankcases per hour, and provides practically continuous cutting, the operator being only required to load and unload the cases on the rotary table. This machine, which is illustrated in Fig. 2 is a special machine made by the Ingersoll company for this particular work.

After the oil pan face has been milled off, the milled face and the dowel pin holes are used for locating practically all of the following operations. The next operation is to drill and ream the oil pan and dowel pin holes. The work is done on the Leland-Gifford two-spindle machine. The work is located from the oil pan face and the two pads on the right side of the case. There is a V-block for endwise location.

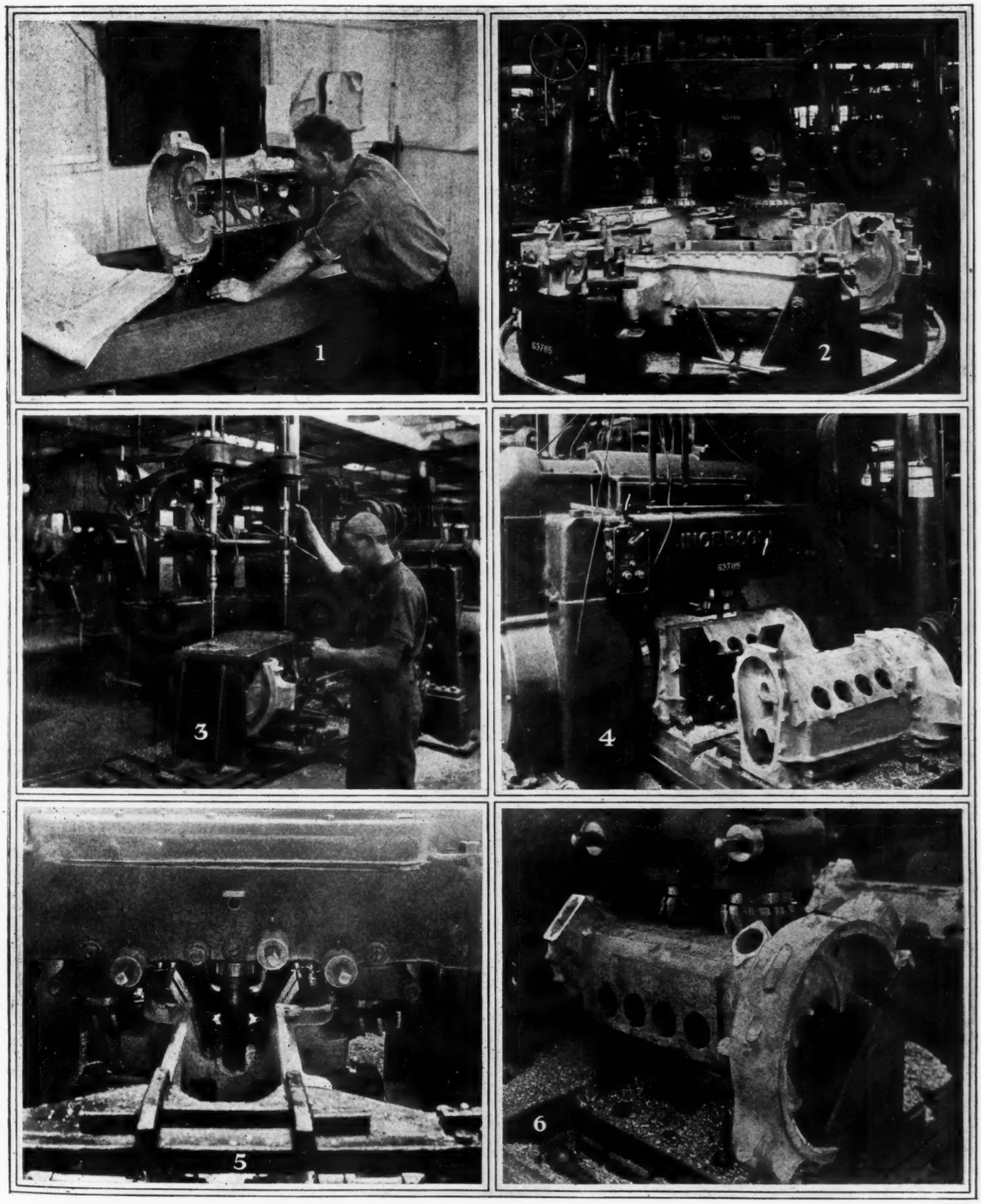
An Ingersoll miller is used for facing off the timing gear ends of the crankcase and also the generator and distributor pads. These pads are on the top surface of the case and the work necessitates the simultaneous operation of three cutters. The machine is designed to be loaded while in operation so that a minimum amount of time is lost between cuts.

Another Ingersoll machine mills the main bearing surfaces and the motor support arms. This requires three cutters, the operation being shown in Fig. 5. The location for the work is from the oil pan face and the two pads on the right side of the crankcase. Following this operation, the cylinder contact face is rough milled on an Ingersoll milling machine. The location for this work is from the dowel holes and the work is handled by putting the crankcase in, first on one side and then turning over to the other side to take care of both cylinder block contact faces. A similar machine is used for taking the finish cut on these contact faces, the operation being similar to that shown in Fig. 6, which illustrates the rough cut.

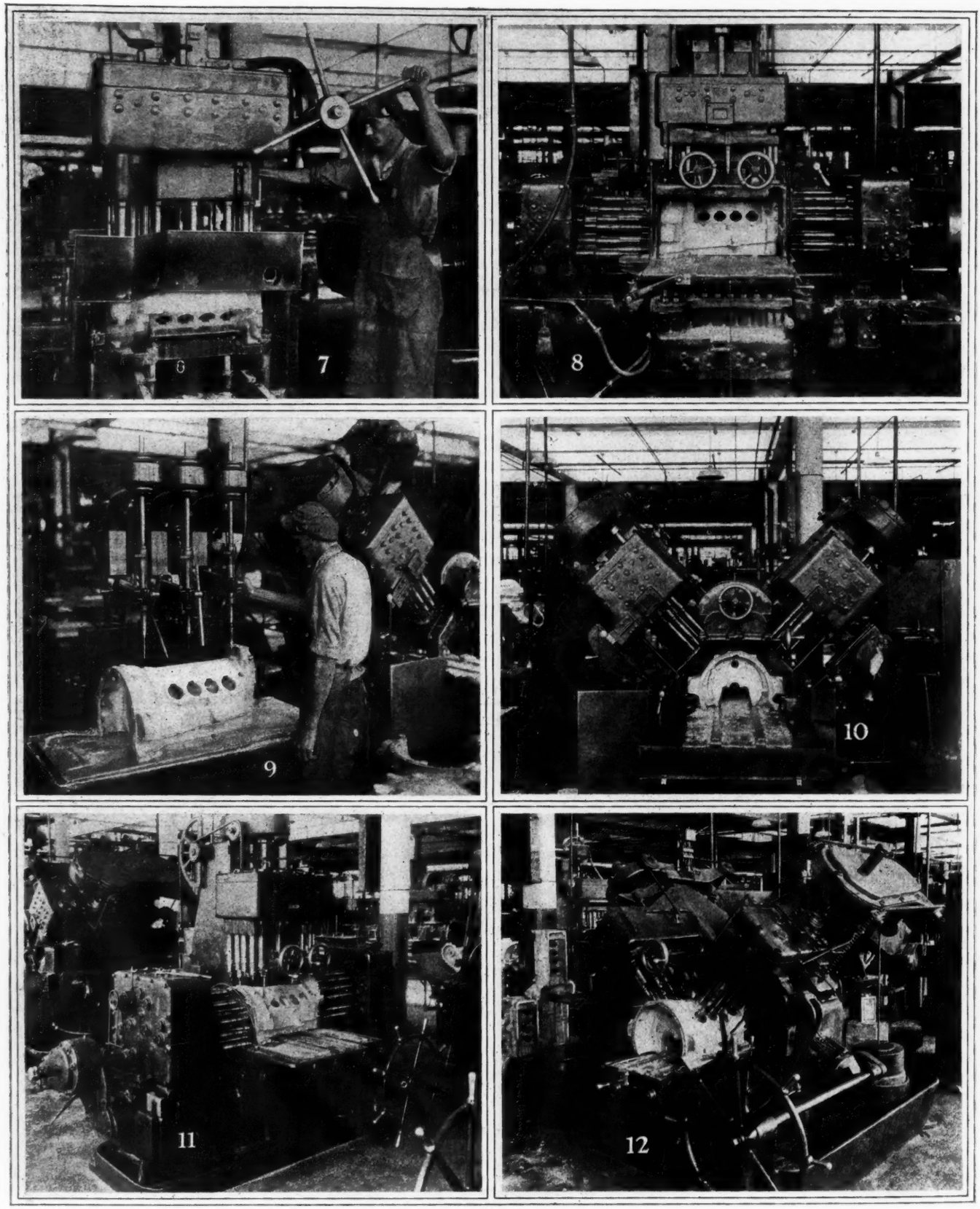
A 22-spindle Foote-Burt machine drills all the holes for the main bearing studs, for the main bearing dowel holes, the sod pan holes and the motor support holes. The work is located from the dowel holes and the crankcase is handled in a pedal operated, elevating jig. This is a very good example of special machine drilling work and is illustrated in Fig. 7. Another very good illustration of this type of work is in the following operation, which is also handled on a Foote-Burt machine, as illustrated in Fig. 8. The work consists of drilling the oil pan holes and also the holes for the clutch housing, crankcase cover, rear, gear-case cover, front cam bearing stud, distributor brackets, spark control brackets, generator bracket stud, main oil line, and the oil pressure gage screw hole, giving a total of 77 spindles. It is a four-way machine and supplants equipment which a few years ago would have comprised from five to ten machines. This work is all located from the dowel holes.

For drilling the center cam bearing lock screw hole and the front cam bearing oil hole and spot facing both these holes a 3-spindle Leland-Gifford is utilized. These are all separate operations done one at a time on this machine as illustrated in Fig. 9.

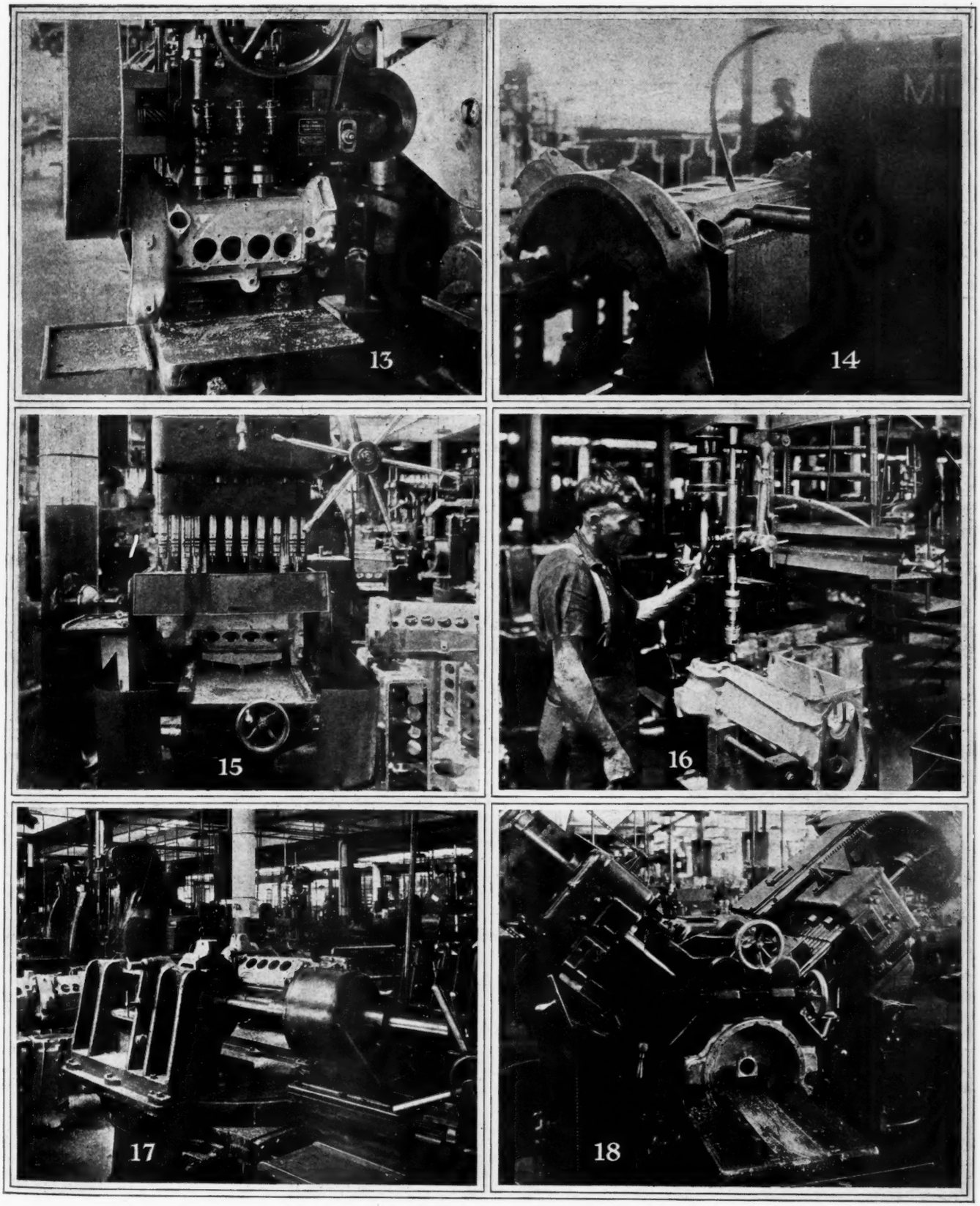
One of the operations which illustrates the special machine required for eight-cylinder V-type crankcases is illustrated in Fig. 10. This is a Foote-Burt, two-way machine, which reams the piston clearances and drills the holes for the cylinder contact studs, the dowels for the cylinders, oil returns and main bearing oil leads. The machine also reams the cam bearing lock screw holes and the



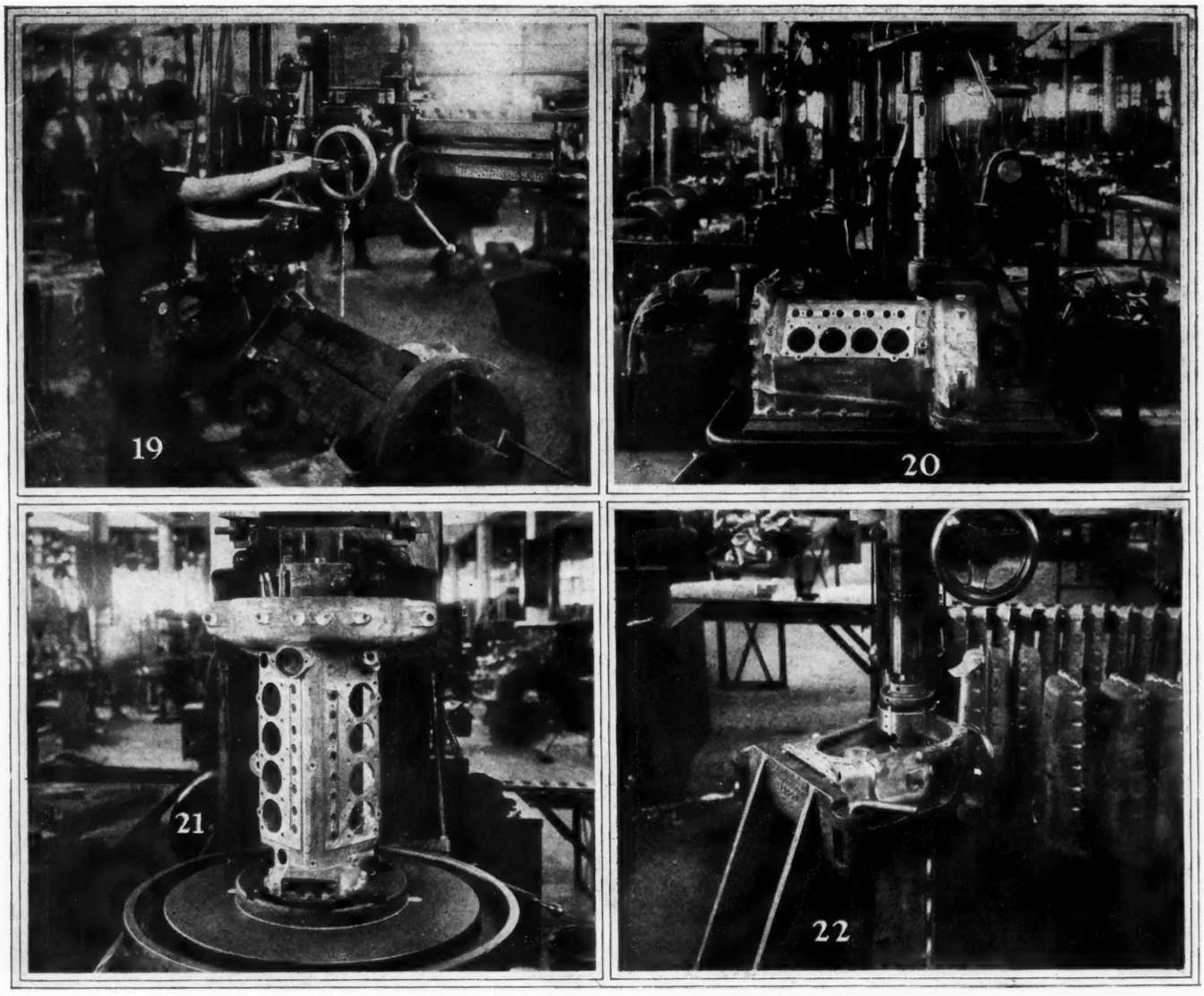
1—Final checking and inspection of crankcase on surface plate.
2—Milling the oil pan face on Ingersoll rotary miller which holds 5 cases at a time.
3—Drilling and reaming oil pan and dowel pin holes on a Leland-Gifford two-spindle machine.
4—Milling timing gear end, generator and distributor pad at the same time on Ingersoll machine.
5—Milling main bearings and motor support arms at same time on Ingersoll miller.
6—Rough milling the cylinder contact face with two cutters operating simultaneously on Ingersoll miller.



7—Drilling for main bearing dowel and other holes on Foote-Burt machine
8—Four-way drilling operation on special Foote-Burt machine with 11 spindles
9—Leland-Gifford machine drilling center cam bearing lock screw holes, front cam bearing oil holes and spot facing holes
10—Reaming piston clearance on special Foote-Burt machine, which also performs other operations described in text
11—Three-way tapper which takes care of clutch housing and other holes. This is a 48 spindle machine
12—Two-way Foote-Burt tapper taking care of cylinder block stud and other holes




13—Automatic profiler for milling valve lifter guide seat
14—Milwaukee miller for valve inspection cover
15—Tapping main bearing stud holes and oil pan screw holes with 31 spindle Foote-Burt machine
16—American radial utilized for retapping oil pan and other screw holes
17—Rockford horizontal drill for rough boring cam and crankshaft bearings
18—Two-way Foote-Burt machine for drilling valve lifter guide holes




19—Holland radial and tumble jig used with indexing fixture for drilling valve lifter guide stud and other holes. 20—Reaming distributor bracket hole on Foote-Burt machine. This machine also drills and reams oil pump shaft hole and other openings in the case. 21—Ingersoll machine for milling clutch housing and rear crankcase cover. The work is located in this operation from the crankshaft bearing by means of bar which passes straight through. 22—Facing front camshaft bearing on Cincinnati drill

breather tube and oil gage holes. It handles the work for all eight cylinders at a time, having 39 spindles and being a specially designed machine throughout, particularly for this V engine. The machine has a capacity of from 20 to 30 crankcases per hr., which readily allows it to take care of capacity production by the rest of the machines in the shop.

A special, three-way, Foote-Burt tapper taps the clutch housing holes and also the holes for the rear crankcase cover, control brackets, distributor brackets, generator bracket pad, main oil line, gear cover stud, and the front cam bearing stud. This necessitates 48 spindles for the work and the holes are all tapped simultaneously. It will be noted from the illustration that in practically all of these operations the crankcase slides on the jig and the locating dowels are elevated when the case is in place. The nature of the machine equipment for a V-type of engine is again brought out by the two-way Foote-Burt tapper shown in Fig. 12. This machine taps the cylinder block stud holes, the rear cam bearing lock screw holes, the main bearing oil line holes and reams the breather holes and the holes for the oil gage. The location is by the dowels as for the other similar operations and the clamping arrangements for the work are also similar.

The profiling operation for milling the valve lifter guide seat is done on an Automatic Machine Co. profiler with three cutters. This operation, which is shown in Fig. 13, is handled at the rate of 20 per hr. readily, so that this machine holds its position in the production line and balances with the rest of the shop equipment. A Milwaukee miller, shown in Fig. 14, mills the valve inspection cover face. This work is located from the cylinder dowel holes and the jig is so arranged that the work can be turned over for the similar operation on the other side of the case. A Foote-Burt tapper taps the main bearing stud holes and the oil pan screw holes. This is a 31 spindle operation and is shown in Fig. 15. The same dowel location is used for this work.

In order to be sure of the size and quality of the threads in the oil pan screw holes, an American radial is utilized for re-tapping all of these holes and also the main bearing stud holes. This machine drives 8 studs and the bearing and cap is assembled on this same operation. The nuts are put on the studs and the machining shims put in place in the bearing. An Errington tap chuck with a friction release is used for putting on the nuts with uniform tightness.

After this operation, the work is passed along to the

Rockford horizontal drill shown in Fig. 17. This rough bores the cam and crankshaft bearings on Kelly reamer bars. To expedite the work, a rotary indexing table is utilized so that one may be loaded while the other is being cut. The table is then swung around, indexing properly for the operation to go ahead on the next case while the first case is being unloaded and another slipped in place.

Another Rockford horizontal drill exactly the same as for the previous operation is used for facing the crankshaft bearing. The Kelly bar has four cutter slots, allowing two cutters to work forward at a time and then two back at a time. Another machine of the same description is used for making the finish cut.

After the bearings have been cut by this method, the case is forwarded to a Foote-Burt, two-way machine for drilling the valve lifter guide holes, as illustrated in Fig. 18. These are all drilled simultaneously and the crankcase is then passed to a Holland radial drill, which drills the valve lifter guide stud holes, the main oil line holes and spot faces the control bracket bosses and the oil gage bosses. This work is handled in a tumble jig with an indexing fixture, illustrated in Fig. 19.

The case is then reamed on a Foote-Burt reamer which takes care of the distributor bracket hole and also drills and reams the oil pump shaft hole and distributor drive shaft hole. This is a single spindle machine. This machine also finishes the distributor boss, using a combination facing tool and reamer.

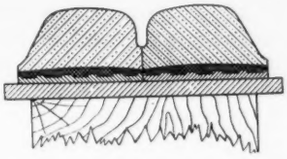
The crankcase is stood on end for the next operation, which takes place in an Ingersoll milling machine. This mills the clutch housing and the rear crankcase cover. The work is located from the crankshaft bearing holes by means of a bar which passes straight through. There are five cutters on this machine taking care of this work. The operation is shown in Fig. 21. The front camshaft bearing is faced on a Cincinnati drill, the work being located from the dowel holes. This operation is shown in Fig. 22. The crankcase is then passed to a Holland radial drill which takes care of the rear crankcase cover dowel holes, the oil return pipe holes, two stud holes in the main oil line and drills on top the oil line lock screw hole in the front end of the case. The finishing operations on the case consists of drilling the bearing studs on a Hammond radial and tapping the valve lifter guide stud holes on a two-way, eight spindle, self-reversing Leland-Gifford automatic tapping machine.

# Some Recent Automotive Developments

## A French Solid Tire

A NON-SYMMETRICAL dual solid rubber tire has been put on the French market by Bergougnan specially for use on the rear wheels of 3 to 7-ton trucks. It is claimed that this new construction combines all the advantages of the round with the flat tread tire without any of their respective disadvantages, and is an improvement on the big single solids commonly employed by American makers.

The recognized advantages of the flat tread tire are



The Bergougnan non-symmetrical dual solid rubber tire for use on heavy trucks. It is employed on the Renault 7-ton trucks.

that it conforms to the profile of the road, the load is spread over a bigger surface and it is less inclined to heat. On the other hand, the flexions of the tire under load break down the walls and have a tendency to loosen the soft rubber from the hard rubber base by which it is secured to the steel rim. This tendency is considerably reduced with the round tread tire, for the pressure is transmitted through the axis of the tire; as a disadvantage, the area in contact with the road being reduced there is a greater tendency to overheat.

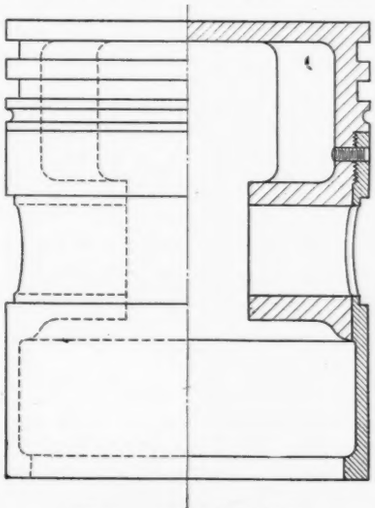
On the new Bergougnan the two rubber bands are brought closer together than usual, as shown in the illustration, giving the theoretical advantages of the flat with the practical advantages of the round profile.

## New 10-Ton Caterpillar Tractor

A NEW 10-ton tractor model specially suited to conditions on the Pacific Coast is announced by the Holt Mfg. Co. It has a rating of 60 hp. on the belt and 38 hp. on the drawbar. Among the new features are pressure oil feed to the crankshaft bearings and better protection of working parts from dust and dirt. The valve push rods are enclosed, the breather and oil filler is of a new type claimed to be dust and dirt proof, and the cylinder heads are completely covered. A new type of air cleaner is included among the items of standard equipment. The transmission has large bearings and cut steel gears.

This new Western model is designed particularly for orchard and road work, logging and general farm work. Full spring mounting is provided. The split truck construction makes the tractor flexible and adapts it to work on extremely rough ground. The driver sits on a cushioned swivel seat and controls the brakes used for steering with his feet. The steering column carries the spark and throttle controls and the two-armed clutch control that releases the drive to one or the other of the tracks. Hand levers control the main clutch and gear shift. A geared hand starter is operated from the driver's deck. The fuel tank is filled from the deck and the flow of oil to the tracks is controlled from there also. Access to the engine can be gained by removing the engine hood and the interior of the engine can be reached by taking off large hand-hole plates.

## Aluminum Piston with Cast Iron Skirt



*Chase composite piston*

T. P. CHASE, formerly chief engineer of the King Motor Car Co., has invented a piston with the head and wrist pin bosses cast integrally of aluminum, while the skirt or remaining portion of the piston is formed of cast iron. In this piston the aluminum is cast on the iron portion. The piston is illustrated in the accompanying part sectional view.

# Insurance Is a Sales Resistant

**Present methods of handling automobile insurance are not satisfactory. Mounting insurance rates are increasing resistance to car sales. It costs more than $150 a year in one town of 175,000 to insure a well-known car for fire, theft, liability, and collision. That is enough to make a man think twice before buying a car. The problem must be considered.**

EVERY factor which acts as a sales resistant is being closely scrutinized by the manufacturer. The mounting costs of automobile insurance are of serious concern, since the item of insurance has now grown to such proportions as to be an important financial factor in car ownership. When an ordinary owner is compelled to pay several hundred dollars a year insurance, in addition to the regular garage and upkeep charges on his car, he is apt to count his resources more carefully before buying the next car. Especially is this true since insurance rates give no indication of having reached a maximum.

One of two things is likely to happen in the case of any individual in the class of what may be called marginal car buyers: those who have just about enough income on which to operate a car but not much more. Such a man is likely to buy the car and take a chance without insurance or simply do without the car.

It will be readily granted, probably, that insurance rates have become a definite sales resistant; that they have increased enormously during recent years. The question of responsibility and possible remedies then arises. It is not possible to decide these questions fully at the present time, especially within the scope of a brief article. The manufacturer should be interested, however, in a brief outline of the situation as it now stands, the contentions, and opinions of some of those concerned on both sides of the case, and an indication of what improvement may be expected from future developments.

There are four kinds of automobile insurance to be considered, each of which presents a somewhat distinct problem. These are:

1. Fire
2. Theft
3. Collision
4. Liability

### Fire and Theft

Fire and theft insurance are usually written in one policy and present similar problems to a large extent. The theft question was discussed at length at a recent meeting of the Metropolitan Section of the S. A. E. At that meeting automobile men, police officials and insurance men voiced their various opinions. The expressions of this meeting, together with interviews with a number of persons intimately connected with this work, gives a clear general idea of the present situation.

The N. A. C. C., representing the views of the manufacturers, feels that the reason for high insurance rates is "the loose methods of accepting risks" used by the insurance companies. It has been the habit of the insurance companies to write fire and theft insurance up to the full value of the car. Since a car continually depreciates, of course, this practice makes it actually profitable for a man to have his car stolen.

Such a condition is a direct encouragement to the dishonest man and is an incentive to carelessness on the part of the average owner. The objections to present methods of writing such insurance can probably be best stated by quoting from the statement recently issued by the N. A. C. C. This statement says in part:

"The moral hazard receives no consideration. A burglar just out of jail gets the same rate as a respectable citizen.

"The amounts allowed on cars and trucks almost encourage their being burned up or destroyed to be reported as stolen.

"We hear many times of legislation to force everyone to take a bond on their car on the ground that it would prevent accidents. Such action would make accidents more frequent because it would shift the responsibility of the driver.

"It would be of more help in preventing accidents if no owner was permitted to carry liability insurance and no car was equipped with a horn.

"A sedan insured new last year for fire, transportation and theft to the amount of $2,600 at a cost of $33.80 has just been renewed at a cost of $55.00 and is now covered for $2,500. The policyholder in this case is displeased at the amount of the premium and surprised at the amount of the coverage, as he would gladly take $2,000 for the car.

"At the same time we read, within the last few days, of several automobiles being found in Lake Erie, near Buffalo, where they had been intentionally dumped, another in New York Bay and a half dozen in an old quarry in Illinois.

"These facts undoubtedly throw a great light on the high cost of automobile insurance, and it is evident that the methods of writing ordinary fire insurance on buildings and furniture without actual knowledge of the value of the property insured, will not do at all for automobiles."

### Companies Changing Attitude

The attitude is that the insurance companies care chiefly about writing as high amounts of insurance as possible because the higher the amount the greater is the broker's commission; that the increase in rates is a matter of little moment.

An examination of the situation indicates, however, that there is something to be said on the other side of the case. As insurance rates rise, a greater sales resistance is created for the insurance companies as well as for the automobile manufacturers. The insurance brokers have a problem of salesmanship on their part. Some of them, at least, realize that lower rates would probably mean the writing of a greater amount of insurance. In any case, the insurance companies claim that they are constantly striving for minimum rates and that they are directing strenuous efforts in that direction.

A new type of policy is being written by the so-called conference companies which is a step in the direction of removing the incentive to dishonesty previously mentioned.

This is what may be called a non-value policy. It insures a car without naming a definite value. Then when the loss occurs, the value is determined by the used car value of the car. If a 1921 Buick were insured to-day, for instance, and were stolen in 1922, the owner would receive from the insurance company the value of a 1921 Buick at that time.

This policy meets many of the objections raised, and while not the last word, is a definite step in advance. It is still possible, however, for the owner to get definite value fire and theft insurance from certain companies. The chief difficulty with the non-value type of policy is well stated by C. S. Disbrow, president of the American Automobile Insurance Co., who says in a recent number of *The Weekly Underwriter:*

"Some underwriters maintain that any amount of insurance may be granted if a non-valued form of policy is used. This is not so. The psychological effect of the large insurance policy and the much smaller sales value of the car is still there. Few assured know the meaning of the non-valued policy and the broker is apt to gloss it over. . . . In some states the law makes all policies valued anyhow. . . .

"If the companies wish to eliminate crooked losses it is easily within their power to do so, either by lowering the amounts of insurance or by issuing a daily or monthly depreciating policy, so that the amount of insurance will at no time exceed the trading in value of the car."

The manufacturer has several sources of direct, but comparatively unimportant, contact with the matter of fire and theft rates. These are in connection with identification systems, theft locks, and mechanical construction and equipment as regards fire hazards.

A number of suggestions as regards identification systems have been made and work along this line is already being carried on. It would probably be to the advantage of the manufacturer to equip his cars with a recognized theft prevention device. In New York City at the present time there is a definite insurance rate penalty of $25 on the car not so equipped, while the car that is equipped saves that penalty and 15 per cent besides. The manufacturer can always equip a car with such a device, of course, cheaper than the owner can buy it retail after he has purchased the car.

The Underwriters' Laboratories are carrying on extensive tests for the purpose of classifying automobiles as to protection against fire and collision hazards and their equipment of theft retardants. The schedule recognizes seven principal groups of items affecting the fire hazard and to each group is assigned a certain proportion of the total points to be used in rating. While these tests are very comprehensive and the results are likely to be excellent, their importance is minimized by the fact that the factors which they consider are of slight moment when compared to the larger factors just discussed here. The chief difficulties lie in methods of writing insurance rather than in mechanical features of car construction.

### Collision Insurance

Methods of writing collision insurance have been subject to many of the criticisms directed against fire and theft methods. It has been objected that the driver, being fully covered for all damages to his car, was likely to be more careless in driving than if he had some personal responsibility in the matter.

A number of the larger companies have recently eliminated full coverage collision insurance. The policies written by these companies now make the owner responsible for the first $50 or $100 of each collision loss. Such a policy tends to make the owner more careful and at the same time gives him insurance in case of a serious accident. Thus it operates to the benefit of all concerned, as well as reducing expenses for the insurance companies by eliminating the handling of small claims which cost more in overhead than in actually loss payment.

### Liability Insurance

Liability insurance constitutes the most important phase of automobile insurance both from a financial and a human standpoint. The cost of fire and theft insurance is not nearly so large actually as liability insurance, while the rise in liability rates means more than money—it records an increase in human suffering and the loss of human life. It is a matter of record that the number of automobile accidents have increased in this country during recent years. But it is not this increase alone that has caused liability insurance rates to advance. The claim cost to the insurance companies has increased greatly. That is, the cost of court actions, payment of awards, etc., have increased per case; an increase not affected by the actual increase in accidents. The figures for one of the largest companies, for instance, run something like this:

> The cost per liability case in 1918 was 24% greater than in 1917.
>
> The cost per liability case in 1919 was 45% greater than in 1917.
>
> The cost per liability case in 1920 was 60% greater than in 1917.

This increased cost has been brought about largely by the increased amounts which juries have been awarding to injured persons in liability suits. As the cost of everything has risen during recent years and as people have lived on a more expensive scale, so have the liability awards kept pace. This fact, together with the tremendous increase in the number of accidents, has sent liability rates far up, until they are now a very large factor in the minds of many prospective automobile owners.

There is nothing being done as regards liability policies that is analogous to the elimination of the full coverage collision policy. In other words, it is still possible for the owner to insure himself for a large amount and then run down a man or woman without losing a cent. It would certainly seem logical to provide some form of policy which would place a certain amount of liability on the owner of the car. Such financial liability might go a long ways toward reducing the number of accidents.

Among the chief faults attributed to present insurance methods is that of failure to properly consider the moral hazard when writing insurance and of failure to properly investigate claims after accidents have occurred. Both of these things could be discussed at great length without any decision being reached, as conversation with several persons interested in one side or the other indicates that there is a very great deal to be said on both sides.

### The Mutual Company Idea

The mutual insurance company idea is being seriously discussed as a means of relief from high insurance rates. To quote again from the N. A. C. C. statement on this subject:

"It is very well to say that one who uses the mutual assumes a liability, but this is losing force from experience to the contrary; dividend of from 25 per cent to 50 per cent, compared with standard rates, have for long periods been received on premiums by their policyholder.

"According to figures given out by 131 insurance companies the fire and theft premiums received by them in 1920 amounted to $74,472,250. The losses paid amounted to $42,935,748. It would be interesting to know the proportion of these losses that went to reimburse such costs as noted above (i. e. to careless or dishonest owners).

"Surface indications certainly point to urgent necessity of scrutinizing this moral hazard.

"The makers are convinced that insurance would have offered a much greater sales resistance than it has were it not for the relief offered through lower rates from mutual companies which are operating in all sections of the country."

The objections to the mutual company may be summed up as follows:

1. The ever-present, though perhaps remote, possibility of assessment of the members
2. The lack of facilities for proper service. The big insurance companies with their branches are equipped to render instant and competent service in any part of the country, while the mutual company is likely to have to depend upon a local agent of some kind.
3. In fighting court cases, in paying claims promptly because of the necessity of preserving good will for future business, in permanency and stability, the regular large insurance companies are equipped to render many services not possible in the case of the mutual company.

One insurance man put it something like this: "Yes, you can get lower rates at the mutual companies. You can buy fish at a cheaper price if you go down to the dock and carry it home; you can get the fish for nothing if you go out and catch it. The regular insurance companies render a service for their higher rates that is far more valuable than the difference in the rates."

It has been suggested that a law compelling every car owner to carry insurance might be of advantage. It is argued that such compulsory insurance would protect the pedestrian by making every driver financially responsible and would benefit the driver by setting definite money judgments for specific injuries.

The effect on rates of such a law is problematical. Some insurance men, for example, believe that it would tend to reduce rates because of the greatly increased number of persons who would be paying insurance premiums. Moreover, the stated amount for injuries would tend to reduce the amounts necessary for the insurance companies to pay out to injured persons, with a corresponding decrease in cost per case.

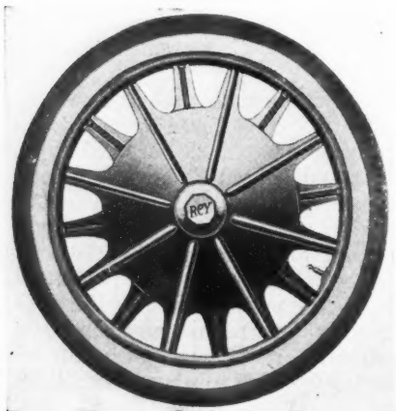
On the other hand, the fixed judgment limits and the freedom from financial liability on the part of the driver might increase careless driving and the taking of risks. It would place the driver at the mercy of the insurance companies to some extent, as their rates would be governed then only according to competitive rates of other companies and not by the sales resistance factor which now operates. This would not be true, of course, if the rates were regulated by the law.

It is not the purpose of this article to decide the merits of the case; the two sides have merely been presented for the consideration of the manufacturer. The entire problem of insurance is important at the present time and calls for serious and thoughtful consideration by the automobile manufacturer.

# A Steel Disk Wheel

A STEEL disk wheel the disks of which are spoked on their circumference is shown in the accompanying cut. Lightness and the possibility of quick tire changes are claimed as the advantages of the design. The disks are solid to within 3½ in. of the rim, where they branch into spokes. They are of convex shape and come together on the circle where the disks and spokes join, the eight spokes of the outer disk abutting an equal number of lugs on the inner side of the rim and the spokes on the inner disk abutting lugs on outer side of the rim. This trussed construction gives great strength to resist lateral stresses, it is claimed. The disks are further reinforced by beading. Disks and rim are held together solely by the pressure of the hub nut, the radial component of this pressure against the rim lugs amounting to 15 per cent of the total pressure. A locking device is incorporated in the nut.

It is claimed that the wheel will always run true, even though the rim might have been out of true before assembly. The disks are secured to the wheel hub by means of six or more studs. As compared with the full disk wheel, the advantage is claimed that there is no interference with access to the tire valve. As regards weight, it is stated that the 30-in. wheel is 10 lb. lighter and the 32-in. wheel 15 lb. lighter than the standard wood wheel.




Rey steel disk wheel

When a tire and rim change is to be made, the hub nut is loosened (not removed), which allows the plates to contract. The finger is then placed on one side of any spoke in the outer disk and the disk is rotated so as to clear the lug, whereupon the rim and tire may be removed. The disks are made of molybdenum steel, the hubs and hub nuts of malleable iron or forged steel, and the brake drums of pressed mild steel. It is the intention of the manufacturers, the Rey Wheel Co., to first put out a Ford wheel of this design, to be followed by 30, 32 and 34 in. sizes.

## New Stewart Speed Truck

A NEW 1-ton speed truck is announced by the Stewart Motor Corp. The machine is claimed to cover from 14 to 16 miles on one gallon of gasoline, to be capable of a maximum speed of 40 m.p.h., and to be able to negotiate grades of 22 per cent with capacity loads.

The engine is a Buda four cylinder 3⅝ by 5⅛ in. Ignition is by Eisemann magneto, and the carburetor is a Zenith. Fuel is fed by gravity from a 16 gal. tank under the seat. Engine lubrication is by the full pressure system and chassis lubrication by the Alemite system. The radiator is of the cast iron armored type with vertical tubes and has a capacity of 5 gal. The clutch is of the multiple dry disk type making use of molded asbestos disks. Annular ball bearings are used on the transmission shafts. The rear axle is a Clark internal gear drive type with a 6.75 to 1 reduction ratio. Other ratios are as follows: Intermediate, 11.48 to 1; low, 27 to 1, reverse, 30.38 to 1. Frame side rails are of channel section of the following dimensions: 4½ x 2¼ x 3/16 in.

The truck is equipped with 35 x 5 in. cord tires all around. The regular equipment consists of electric headlights, electric tail lamp, tool box, 111 amp.-hr. Willard storage battery, tools, jack, horn, etc. The price of the chassis f.o.b. Buffalo is $1,875.

## Aluminum Pistons

*Editor*, AUTOMOTIVE INDUSTRIES:

We have read with much interest Dr. Rosenhain's article on "Problems and Possibilities of the Aluminum Piston," which appeared in your publication for June 16, 1921. On the whole this article brings out many interesting and valuable points concerning the aluminum piston. A few statements in the article lead one to believe, however, that Dr. Rosenhain is not familiar with all of the latest developments made in aluminum pistons. In the paragraph headed, "Advantages and Disadvantages of Aluminum Pistons," he mentions the higher co-efficient of expansion of aluminum over that of cast iron. This, of course, is quite true. Recent experiments, however, have definitely shown that the maximum temperature drop is across the rings, which would seem to indicate that most of the heat leaves the piston through the rings, leaving the skirt comparatively cool. Dr. Rosenhain makes a statement later on in his paper exactly opposite of this, inasmuch as he states that most of the heat leaves the piston through the skirt. The temperature of the skirt is not high enough to account for all of the clearance it was formerly necessary to give aluminum pistons, even though the co-efficient of expansion of aluminum is about twice that of cast iron. The only conclusion that can be reached is that the skirt expansion can be divided into two parts:

(1) The thermal expansion due to the actual temperature of the skirt.

(2) A mechanical expansion due to the thermal expansion of the head.

The head being so much hotter than the skirt will naturally expand more and to a certain extent will pull the skirt of the piston with it. To make this skirt expansion harmless a new design having a slot separating the head from the skirt immediately below the last ring on the thrust faces has been made. The head can, therefore, only distort the piston skirt along the axis of the wrist pin. This expansion is made harmless either by relieving the piston on the side or by means of a vertical slot in the low thrust side of the piston. The expansion of the piston skirt along the axis of the wrist pin actually sets up forces tending to contract the piston across the thrust faces which still further reduces the clearance necessary. Pistons of these designs as well as the temperature distribution obtained by actual measurements were discussed in a paper which the authors read at the Buffalo Section of the S. A. E. and which appeared in the S. A. E. Journal, issue for May, 1921.

It seems as though Dr. Rosenhain were laying too much stress on the reduction of strength of aluminum piston alloys at high temperatures. Piston failures due to the metal actually failing in pistons has been very rare, particularly in automobile engines.

Under the heading of "Piston Pin Bushings and Piston Rings," the statement is made that when a floating pin is used it is necessary to cast in, or screw in a cast iron bushing. It has been the experience with aluminum that it affords an excellent bearing surface for a hardened steel wrist pin and the practice of inserting bushings of any description for floating wrist pins is not general, in fact, it has been resorted to only on very few occasions for the simple reason that the performance obtained by simply floating the pins in the aluminum has given such good results. It is, of course, necessary to make the pin a rather tight fit when the piston is cold.

Piston rings have, in the past, given trouble both in aluminum and cast iron pistons. Experience seems to point toward the use of the narrower rings than have formerly been in use. Under no circumstances should an eccentric ring be used in an aluminum piston.

FRANK JARDINE,
FERDINAND JEHLE,
Engineers of Aluminum Manufactures, Inc.

## Standardization and Individuality

*Editor*, AUTOMOTIVE INDUSTRIES:

Mr. T. V. Buckwalter's letter in your June 9 issue demands attention mainly for the fact that it comes from Mr. T. V. Buckwalter. It is, however, an example of the somewhat loose talk and discussion that is given to this question of standardization. It is a curious thing that the pendulum in this discussion seems either to swing to the extreme right in favor of complete standardization or to the extreme left in favor of none at all. Surely there is some middle, logical, scientific ground on which we can reason out this subject very fully.

Mr. Buckwalter believes that I think that the automotive industry exists primarily to furnish employment to certain classes of workers. I am at a loss to understand why he should so think, but at the same time even this is a pretty good excuse why the question of standardization should be approached with great care. Would anyone want to see the automobile engineer eliminated? Mr. Buckwalter states that it is undoubtedly true that standardization may result in a certain loss of individuality to the engineer.

This is something very greatly to be deplored. The engineer is the brains behind the design and in many cases behind the construction and production of the vehicle. He is the available human mechanism that brings forth the improvements on which we must run. One has only to contrast the automobile of to-day with that of three years ago, six years ago, nine years ago, twelve years ago, and so on in cycles of three years, to realize the wonderful steps that the automobile engineer has taken. I believe that this has been brought about by the fact that the automobile engineer has a freer scope in individuality of design than the engineer of any other industry. This is typified by the fact that the N. A. C. C. has practically pooled all patents, thereby giving engineers a free range.

At the root of industry you will find a desire to work by certain men. It has been stated that a particular industry is nothing more nor less than the shadow of one man, and behind the incentives that lead this man to create the industry you would find a desire for work and opportunity for himself. Only under conditions

where a tremendous service would be done to the people would the taking away of incentive from a body of men be desirable. One has only to read Mr. Harry Tipper's articles to appreciate the effect of incentive in the human field.

Mr. Buckwalter is very imperative in his statement that "industry must face this fact, that the great American public has let it be known in a most emphatic manner that less expensive automotive transportation is demanded." If this were so, one could readily see a line of people waiting at the doors of the Ford company or the Chevrolet company, and the salesrooms of all other automobile companies absolutely deserted. Mr. Buckwalter has evidently not yet learned that the great American public is composed of a series of strata depending largely upon their incomes. Those with the lowest incomes are naturally content with the cheapest car. Those with greater incomes want better and better cars—the element of the cost of transportation not being the only thing by a long way that enters into the question. I myself have sold a limousine because the color of the upholstery matched the color of a lady's dress.

Naturally, some of this talk does not pertain to the realms of motor trucks, but it is quite conceivable there should be a standard front axle for a one-ton truck and a standard front axle for a two-ton truck, and so on up to the five-ton truck capacity. After reading Mr. Buckwalter's article I am tempted to ask him if he can furnish any good reason why there should not be a standard truck of each capacity. In fact, going back to the war days, why should we not have a standard ¾-1-ton truck like the Class AA, a standard 1½-2-ton truck like the Class A, and a standard 3-5-ton truck like the Class B? Ask the various manufacturers if they would like this, and ask the customers if they would like this, and I believe the answer would be emphatically no. There must be free competition in order to get reduced costs and, what is just as important, improved results.

I stated in my original article this hub standardization has been called for largely because of a failure to standardize the size of taper roller bearings, and in this matter I cannot hold Mr. Buckwalter or his company altogether innocent. At the present moment, although there is an S. A. E. standard for taper roller bearings, it is very rarely used, and, to the best of my recent knowledge, the Timken company has not recognized this standard. There are certain fundamental things which should be standardized, and the size of taper roller bearings is one of them. Not only does the standardization of taper roller bearings affect the front hubs, but it affects the rear hubs, transmissions and other places where taper roller bearings are used. This would be a real far-reaching standardization and of international character.

At the present moment the ball and roller bearing division is considering new standardization work and has held this up due to the fact that Timken are changing their sizes and want a further revision. In other words, the printed, approved S. A. E. taper roller bearing standards are held farcical by one of the leading members of the specific industry.

I believe it was in 1916, at a standards meeting in Cleveland, that I pointed out the desirability for standardizing the boundaries of contact in fundamentals and not details. I still believe in this. I believe, for example, in the standardizing of certain widths and gages of steel for springs; I am a believer in the standardization of rims for all tires, so that one can buy a tire anywhere along the road. Tires do wear out, it is a recognized fact, and therefore there must be a standardization of the boundary of contact between the tire and the vehicle. I am a tremendous believer in standardization in one's own shop, making the smallest number of models or products that will fill the demand, and standardizing these and their component parts to the best possible combination. I still feel that the introduction of a standard has quite often meant merely the addition of another article to be manufactured.

I had an experience some years ago when I sought to standardize bushings for a line of passenger cars and trucks, five models in all. I confess I found it an impossibility, as the bushing is so often used as the flexible link in a chain of mechanism, and yet, at first glance, the bushing would seem to be something which should be standardized. Similarly with a great many other parts. It is so easy to find reasons why one should not adhere to standards, as they often give way before the elements of expediency.

I apologize for taking up so much of your space on this matter, but the question of retaining our individuality and of keeping in the line of progress, not merely from a cost standpoint, but from the final result standpoint, is so strong within me that I feel I have to answer this. I just received a letter from the headmaster of the largest technical school in the city of Glasgow—Dr. John G. Kerr—in which, in connection with another matter dealing with the standardization of examinations that are given to young men before they start out in the universities, he states: "I may perhaps be wild in my belief about the importance of individuality, but that belief grows more and more with the years." This statement is made by a man who has had the training of men in his hands for some fifty years. I think you will find the desire to escape from monotony one of the strongest incentives of the human race.

JOHN YOUNGER,
Vice-President, Standard Parts Co.

## Horsepower Correction Factors

*Editor,* AUTOMOTIVE INDUSTRIES:

In your June 30 issue appeared a Horsepower Correction Alignment Chart, which is based on the assumption that power is proportional to air density. The Bureau of Standards tests and many others have shown us that power is not proportional to density for temperature changes. Is the assumption used correct? The power should be proportional to air density if the volume were constant, which would be the case if the engine were a straight displacement proposition. This is not the case, however, with the air passing through poppet valves. These have the effect of orifices and the air flow should be investigated on air orifice flow bases. An examination of the orifice equations for air flow will show that the volume of air changes with temperature, which eliminates the density assumption as far as temperature changes go. Further examination of the orifice equations will show us that the horsepower should vary as $\frac{1}{\sqrt{T}}$ absolute. Therefore our correction formula should be

$$\text{B.Hp. (corr.)} = \text{B.Hp. (obser.)} \times (P_s \div P_o) \sqrt{T_o \div T_s},$$

where $P_s$ and $P_o$ are respectively standard and observed barometric pressure and $T_s$ and $T_o$ are standard and observed absolute temperatures.

The writer has checked this formula against "air temperature vs. power" tests from different sources, including part load tests, and found that the horsepower change was very well expressed by this new equation, whereas the density assumption showed a change nearly twice as great as actually observed. The Bureau of Standards correction gives practically the same factors as the new equation.

Why, then, should we continue to use a correction for

temperature that is 100 per cent in error? For example, to correct power at 29.92 in Hg. for air of 90 deg. Fahr. we get from the chart a correction of 5.8 per cent., while the Bureau of Standards correction factor shows us that actually the engine would only pull 3.1 per cent more power at 60 deg. Fahr. than at 90 deg. Fahr. With our present day air stoves, raising the air temperature to 150 deg. Fahr. and over, the error involved in these corrections certainly deserves consideration. At least let us question the density assumption until it is shown to be correct. I believe the orifice flow basis to be the correct one to work on and the new equation is the result of work on this basis.

HAROLD S. WHITE.

## Reasons for 56 in. Gage and Contracting Brakes

*Editor*, AUTOMOTIVE INDUSTRIES:

The remarks by Mr. W. J. P. Moore, published in last week's Forum, in which mention is made of some of the statements made in my letter published in your issue of June 16, in connection with passenger car brakes and passenger car seating capacity are well worth considerable thought.

In regard to paragraph 7 I am under the impression that the standard tread of automobiles is taken from railroad practice in regard to the standard gage of railroads. In the majority of countries this is 56½ in., though there are a number of other gages in use. I do not believe that there was ever any very definite figure in regard to the standard carriage tread, though it has been for years recognized that in the neighborhood of 56 in. was the standard for the Northern States, and, I believe, 60 in. for the Southern States. The writer made the tread during the last fifteen years 56 in., until the time that we used the cross section of tire of 5½ in. instead of the 5 in. that we formerly used. Then in order to provide the same clearance between the rear wheels and the wheel housing and in order to obtain the same lock on the front steering wheels when tires of 5½-in. cross section were used, the tread of 56½ in. was adopted and the slight increase has been appreciated. I believe that there are many reasons why automobile manufacturers in this country should adhere to approximately this tread as standard—the trolley rails are also 56 in. gage and there are many cases where it is desirable to run automobiles along the trolley rails, although this is not good practice where the rails are worn because it may result in badly cut tires. Although there are a great many miles now of improved highway, the vast majority of roads in this country are clay, mud and dirt and these roads have very distinct ruts that make it almost impossible to travel on unless the car has approximately 56-in. tread. Due to the means of repairing roads in this country, it is rarely ever possible to take a trip even along the main highway between such cities as Buffalo and New York without having to make detours which, in most cases, take one along dirt or clay roads, which very soon become deeply rutted.

If the buying public would consent to the elimination of seats to carry three people in automobiles, there is nothing wrong with making approximately 56 in. the standard tread, and there is absolutely no objection to a standard tread of this kind where good concrete, brick or macadam roads are prevalent, as on such roads a car rarely if ever follows in the track of the preceding car. Almost all drivers keep close to the middle of the road except when passing another vehicle when they go over to the right-hand side, so that almost every part of such a road is traveled on and there is certainly no need for cars of varying treads on such roads.

In regard to paragraph 21, in cases where good roads prevail it is an advantage, perhaps, to have a narrow tread on very small cars. This is the regular practice in France and England. In the case of large cars it would appear to the writer to be impractical to have a tread in excess of 60 in. The present design of automobile has had such an enormous start that it will be impractical to-day to make cars of 65 or 70-in. tread, as there are thousands of exceedingly expensive garages that have been built with the width between the doors that only permits of a clearance of 6 in. on each side with the present type of car with approximately 56-in. tread, and it would be impossible to drive into such garages with a tread much in excess of this. Unfortunately many of the latest improved highways are almost too narrow for cars of approximately 56-in. tread and would certainly be inadequate for cars of from 65 to 70-in. tread.

The obstacles in the way of increasing the tread appear to be exceedingly great, whereas the matter of width of seats is largely one of public opinion and is a matter that should be changed without imposing any great sales resistance or any hardship to anyone. Either closed or open bodies have a much better balanced appearance when they are about 10 in. narrower than the regular three-passenger rear seat body. The problems of body construction are much easier to meet in the narrower body—the side window glasses can be made to entirely disappear when down, in a narrow body, the riding of a car can be made much better and the adoption of such a design should result in an advantage all around.

In regard to paragraph 31, unfortunately internal expanding brake shoes rarely give the same efficiency as external contracting brake shoes and the most effective brakes on American cars where both brakes are on the rear wheel, are almost always the external contracting brakes. Many American manufacturers have tried experimentally two internal brake shoes side by side on the rear wheels and found that neither foot nor hand brakes were powerful enough to hold the car. This is especially dangerous when a little oil gets on the brake surfaces, which practically never happens in the case of the external contracting brake. The external contracting brake, when in the form of a band brake, gives very much greater braking surface, and this type of brake can be made to be free from the drum when not in use. The internal expanding brake shoes rarely come in contact for the whole of their surface, in many cases they bear only on the ends of the shoes, resulting in very rapid wear to the brake lining and necessitating very frequent adjustment. The majority of American car manufacturers use the external brake as the service brake because of its being much more powerful and having a great deal more life than the internal brakes.

In the case of four-wheel brakes it is probably essential that external rear brakes will still be required in order that the car may be equipped with two absolutely independent brake systems, so if the foot-brake connection should become severed the driver will always have the hand brake to fall back on with its absolutely independent set of brake shoes, levers, rods, etc.

DAVID FERGUSSON, Chief Engineer,
The Pierce-Arrow Motor Car Company.

## Interchangeable Automobile Parts

AUTO Gear Information Service, published by Auto Gear Information Service, is a booklet containing 300 cases of interchangeable gears and axles, including cars from 1912 to 1920, giving the gear ratio on various cars that have identical gears.

# Human Difficulties Predominant in Building Trades Wastes

**The recently issued report of the American Engineering Council concerning waste in the building industry indicates that many difficulties grow out of unsatisfactory human relations. Mr. Tipper here analyzes this report and illustrates the significance of the most important points.**

By Harry Tipper

A FEW days ago the newspapers were quoting quite extensively from the Report of the American Engineering Council upon the building industry and the causes for the inefficiency in this industry. The quotations made in the general publications from this report give a fair idea of the conclusions, but do not indicate very thoroughly the most important reasons for the difficulties.

A very large part of this report is devoted to the industrial relations and evidently the difficulties in the industry are to a great extent human ones due to the lack of co-operation and the misunderstanding very prevalent in this field.

The jurisdictional regulations of the union and the restriction of output very properly receive condemnation in the report of the committee and are indicated as great sources of waste and increased cost.

The restrictions of output by the employer through maintenance of price, collusion in bidding and so forth, are mentioned as further difficulties facing this important line of work.

In regard to low output and the general inefficiency of labor, the committee report states:

> "One of the greatest fundamental causes for low output is the fact that all members of unions in the same trade are paid the same wage. There is no incentive. As a result of records made by the authors on actual construction work, it was found that in the building trades on every job there are usually a few men who do one-third more work than the average man on this same job. These men also do better work. Is it fair to these good men for them to receive the same wage as the others?"

These articles have mentioned from time to time the general tendency of uniformity of wages to lead into a uniformity of output below the possible average of a proportion of the men, in other words, the tendency for a uniform wage to bring about a minimum output suited to the average of the less efficient. The more efficient worker will not put forward his power without the incentive of a proportional reward or a difference in the reward established between himself and the other members of the same craft.

> **Particularly where the other incentives of confidence, visible usefulness and individuality of skill are not emphasized and brought out, the plan of the same wage destroys the only incentive remaining. Despite all the developments of organization rules and regulations, the pay is recognized unconsciously as an indication of the value of the skill. The man who is more skillful than his fellows is aware of his skill and he is not likely to put forth his extra capacity where it brings no reward of a visible character.**

The building trades have been notorious for unruly labor conditions and inefficient management. Generally speaking, the unions in this line of work have been more dictatorial in their attitude and more severe in their adherence to privilege than in the manufacturing trades. On the other hand, the employers have been more mandatory in their attitude, less willing to study and determine the reasons for difficulties and less efficient in their ideas of management.

These things are all brought out in the report and they indicate the enormous amount of waste involved in the building industry because of these inefficiencies and these misunderstandings.

The report deals with the difficulty of the seasonal labor as it is at present employed and the cost of maintaining skilled workers on a basis of about half time in order to provide a sufficient number for the peak loads.

> **This question of continuous employment or fairly regular employment is a very important one for this industry, but the question should not be overlooked in dealing with the future of more stable industries where the temporary surplus or shortage affects the regularity of employment. We have not yet arrived at the industrial condition in this country which was the usual thing in Great Britain before the war. We do not have periods of low employment in some industry or another every year. In the readjustment we are likely to find that conditions will remain more or less spotty and the unemployment will bring real hardship or require increased taxes, unless measures can be taken to regularize the employment as much as possible.**

The economic fear of starvation has not operated very actively in this country because of the easier economic conditions. This fear has had its effect in the strongly disciplined unions in Great Britain and in the bitterness existing between the unions and the employers.

> **Altogether the report is interesting as indicating the very large percentage of waste obtaining in one of the most important industries in the country and showing that a major part of that waste is due to the human conditions and not to the mechanical arrangements.**

The report includes the following statement:

> "The most encouraging feature in the building industry to-day is the action of a few of the builders and a few groups of building trade workmen in

making intensive studies of the causes and remedies for irregular employment and haphazard conditions of work. Along with this is the growing appreciation on the part of both labor and management that to build more buildings and maintain high wages it is necessary to attain greater and greater productive capacity per man.

They see as proof of these facts that the 1921 depression was caused and extended by too high costs of all products, and that business, either in manufacturing or in building industries, is improving only as the costs of material and the cost of labor are reducing. All are recognizing, in fact, that no progress can be made without paying greater and greater attention to the elimination of waste.

Never in the history of our country was it so important that certain fundamental principles of economics—principles which are not mere theories, but are based positively on facts—should be accepted and established as a working program. These principles will throw overboard the fallacy that restricting production can make work go further, and will supplant this with the knowledge to get one must give, that to receive the equivalent must be given in money or in time or in effort, and that increased returns can only be attained through increased production."

It will be seen that the hope indicated in this conclusion is a hope for the betterment of human understanding and relations. In fact, the whole question of mechanical improvement, the reduction of costs, the increase in stabilized employment are predicated upon a greater understanding of these fundamental requirements and a greater co-operation between the builders and the unions in working them out.

This report serves to emphasize what these articles have been stating continually—that the wastes in industry are governed most largely by the human conditions and not by the variations in the mechanical equipment and system.

---

# Spur Gear Erosion

F. W. LANCHESTER in an article in *Engineering* of June 17 describes a peculiar form of failure in the spur gears of motor car change gear boxes, which has been observed repeatedly in recent years. In these cases of failure there appears to be a complete breakdown in the region of the pitch line. Usually the gears brought to the repair shop are in an advanced state of erosion; in that case, although the ordinary involute tooth is convex over its whole surface, there is on each tooth a marked depression—a concavity or groove—running along the tooth about the middle part of its face.

When a pair of gears so affected are mounted on correct centers, it is noticed that the depressions are not exactly opposite each other; they are not symmetrical about the pitch line. Generally speaking, the width of the groove covers that portion of the tooth face from a little below the pitch line considerably outwards towards the point of the tooth, and it appears that when the gears are in action the shoulder of one groove eats into and progressively increases the trough of the other.

In the incipient stage of the pitting there is what appears to be an irregular pitting of the gears in the pitch line region, with a certain amount of radial grooving from each pit. Observation of such gears suggested the following explanation to Mr. Lanchester:—

Where gears are under heavy duty the local pressure between the contact lines or areas is so great that no oil film can withstand it for any appreciable length of time. If the oily surfaces sweep rapidly past each other, as in worm gearing for instance, the lubricant has no time to escape. This also applies to spur gears at points remote from the pitch line region, and consequently the tips and roots of the teeth show no signs of failure. On the pitch line itself, where there is only rolling motion, there is no reason to anticipate injury, even though the oil film may break down, for the action is exactly the same as in roller bearings. But adjacent to the line of actual rolling, and far more important, as it is an area rather than a theoretical line, there are regions or bands in which the motion is very slight and where, while there is insufficient relative movement between the surfaces to drag in lubricant in adequate quantities, there is at the same time a measurable degree of sliding. Here there is definite metallic contact, the oil film having broken down, and at the same time slow rubbing motion under heavy pressure. Under these conditions seizure between the contact surfaces must be expected, or at least seizure between the surfaces must be regarded as imminent, and a tearing away of one surface by the other.

Furthermore it is quite clear that if we follow the conditions during the passage of a line of tooth contact over the pitch line region we have, before the rolling point is reached, a slowing up of the sliding motion that is symmetrical and in the reverse direction to the subsequent motion after the rolling point is past. Since an oil film takes a certain time to squeeze out, it is evident that the actual metallic contact will tend to take place at or near the rolling point or immediately after that point; the seizure or welding together of the surfaces follows and the tearing away of these surfaces, which causes the phenomenon of erosion, will therefore take place when the rolling point has been passed.

Mr. Lanchester is disposed to think that the remedy lies in the use of high carbon in the steel, obtained either by carbonizing or by providing it in the stock. Where heavy loads are carried seizure can generally be successfully obviated by the use of well hardened steel. In a high duty gear box the elasticity of the gears and the individual teeth is so great that arguments based on the assumption of complete rigidity are of no weight.

In Fig. 1 herewith the sectioned area represents a small particle of the gear B torn out, and the blackened area the consequent groove. Fig. 2 illustrates the incipient stage of erosion and Fig. 3 the advanced stage.

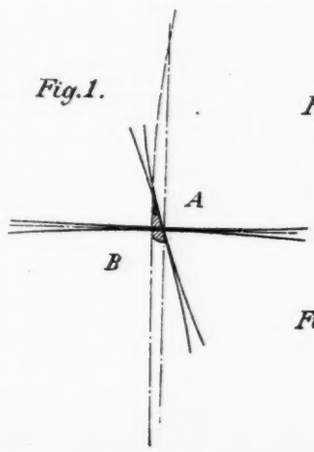



*Fig. 1.*

*Fig. 2.*

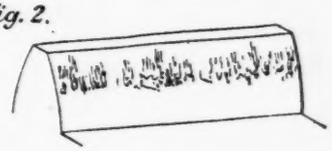
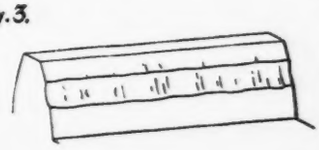


*Fig. 3.*



AUTOMOTIVE INDUSTRIES
The Automobile
Reg. U. S. Pat. Off.

PUBLISHED WEEKLY
Copyright 1921 by The Class Journal Co.

Vol. XLV Thursday, August 4, 1921 No. 5

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
Clyde Jennings, Managing Editor
P. M. Heldt, Engineering Editor
Herbert Chase Norman G. Shidle
DETROIT OFFICE
J. Edward Schipper
WASHINGTON OFFICE
815 Fifteenth St., N. W.

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—317 Fort Street, West, Phone Main 1351
Cleveland—536-540 Guardian Bldg., Phone Main 6432
Philadelphia—1420-1422 Widener Bldg., Phone Locust 5189
Boston—185 Devonshire Street, Phone Fort Hill 4...0

Cable Address Autoland, New York
Long Distance Telephone Bryant 8760, New York

United States and Mexico One Year, $3.00
Extra postage west of the Mississippi River on account of Zone Postage Law, 0.50
Canada One Year, 5.00
Foreign Countries One Year, 6.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

Owned by United Publishers Corporation, Address 239 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; A. C. Pearson, Treasurer; Fritz J. Frank, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of Associated Business Papers, Inc.

Member of the Audit Bureau of Circulations.

Automotive Industries—The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly) July, 1...7.

# The Highway's Chief Enemy

AN interesting statement was made recently by J. N. Mackall, Chairman of the Maryland Highway Commission, in answer to a challenge from a truck manufacturer as to his evidence that the heavy truck destroyed his highways during the war. Mackall, in answer, said that his only evidence was that during the war unlimited loads were permitted on Maryland highways between Washington and Philadelphia and the highways were broken down. After the war, regulations as to weights and overloading were changed and the resurfaced highways had stood the test. Thus, he has removed one cause of failure and the roads have withstood the wear.

In a later statement Mackall revised this viewpoint somewhat and made a statement that brought nods of approval from all his auditors. Without a promise that his words are quoted exactly, his statement was like this:

"We have heard much recently about the effect of sprung and unsprung weights on the highways. I believe there is something in this, but I want to say that while I believe the five-ton truck, weighing a total of ten tons, with half of the weight unsprung, does damage to the roads, I believe that the greatest enemy of the highway is the two-ton truck, carrying a load of five tons with the entire seven tons unsprung."

The manufacturers then had something to say about the damage to the truck that was carrying this excess load. They agreed that the overload was the cause of greatest damage to both truck and highway.

# 40 or More Miles Per Gallon

WHENEVER high efficiency is of paramount importance a powerplant is operated with the best possible load factor that is as near as possible to the load at which maximum thermal efficiency is secured. This is the condition which controls operation of most large powerplants, but it is unfortunately a condition seldom realized in the average automotive powerplant.

The cycle employed in practically all automotive engines is a cycle of high efficiency when a reasonably high compression ratio is employed, providing the engine is run at or near full load. Under these conditions a well designed engine will consume from about 0.5 to 0.6 lb. of gasoline per b.hp.hr. When, however, such an engine runs at light load—the condition which applies during perhaps 90 per cent of the time the average passenger car is running—the consumption per b.hp. will nearly or more than double, due in part to the low mean pressures developed as a result of throttling, and in part to the fact that pumping and other friction losses are approximately the same at a given engine speed whether the load is high or low.

This being the case it is evident that car operating conditions can be improved by at least two methods: by resorting to means for maintaining a constant compression regardless of load or by so arranging the transmission system as to enable the engine to run always at or near full load.

We have discussed the first of these methods in recent editorials. The second method is also worthy of careful study. It will, of course, involve the use of higher gear ratios, and unless changes in transmission design are made, more frequent gear changes than the average American car user is accustomed to, or, according to some persons who are presumed to know the demands of the buying public, willing to use. Theoretically it is possible to design a transmission which will enable, or even automatically compel, the driver to operate the engine at or near full load. Just how practicable a mechanism this would involve remains to be seen, but the possibilities of benefit from an economy standpoint are sufficient to make serious efforts in this direction very much worth while.

One engineer who appreciates the possibilities in this direction fitted to a well known make of car gears which give a 2.5 to 1 reduction as against the standard reduction normally furnished with this car, about 4.8 to 1. The fuel consumption fell from about 28 to approximately 43 miles per gallon. The car is, of course, less convenient to handle, but the owner con-

siders the saving worth the slight inconvenience, and we believe there are a great many owners in precisely the same class.

Be this as it may, it would seem to be no very difficult engineering problem to secure the advantages which are manifestly possible, without either serious inconvenience or undue mechanical complication. We believe the day is not far distant when some progressive manufacturer will reap a well earned reward by putting on the market in advance of less progressive makers a car which will not depart radically in general type, performance or size from the average car of to-day, but which will be capable of traveling in average use fully 40 miles per gallon of fuel. It is quite within the realm of possibility, and to say the least is a contingency which every car manufacturer should be in a position to meet.

## Rejuvenating Old Cars by Grinding

THE grinding machine industry recently has been putting considerable effort into the development of machines for regrinding various wearing parts of automobiles. It is claimed by some that by regrinding all the major wearing parts, the engine at least can be put into a better operating condition than it was in originally. This claim is based on the fact that after an engine has been used for a couple of years and subjected numerous times to both the maximum operating temperature and the lowest atmospheric temperature, its castings have attained a state of molecular equilibrium, and consequently there will be no further distortion. The claim might be disputed on the ground that not all the wearing surfaces of the engine will be ground, and that those bearings or joints which are not refitted will be more or less loose and therefore noisy. At the same time it must be admitted that the engine can be put back in a very good working condition, and there is no doubt that complete overhauling of engines, in which process grinding will play a prominent part, will become more popular in the future than it has been in the past. This will react on the automobile industry in two ways.

Regrinding the cylinder bores, fitting new oversize pistons and rings, and refitting the piston pin, crankpin and crankshaft main bearings will undoubtedly serve to restore the power and fuel economy of the engine, and thus to increase the value of the engine to the user. The latter will not only get better service from the car at less running expense, but the car will last him for a longer period and thus prove a better economic investment. By thus reducing the cost of automobile service the possible field of the automobile will be widened. On the other hand, if cars last for a longer period, the proportion of the machines in use that is scrapped each year will be reduced. While this might be regarded as a loss to the industry, it is hardly to be compared to the gain resulting from the more extensive use of the vehicles consequent upon the lessening of the operating cost as outlined above. Improvements in the methods of maintaining motor vehicles in a good serviceable condition strengthen the economic foundation of the industry and should therefore be welcomed.

## Dr. P. P. Claxton

IN the retirement from office of Dr. P. P. Claxton, former U. S. Commissioner of Education, the automotive industry has seen the official passing of a firm friend. Dr. Claxton viewed, privately and officially, the automotive vehicle as a great transportation unit, one in which there were great social and industrial possibilities. He regarded the automotive vehicle as a means to better and more education and used his official position to make effective that view. He was particularly active in advocating the automotive bus as a means of promoting the long-needed consolidated schools in the rural district. Also he gave credit to the automotive vehicle for the promotion of good roads, which he regarded as one of the greatest educative steps of the last score of years.

His greatest work for the industry, and he regards this step as one of his chief accomplishments from an educational point of view, was his service in injecting into the school systems of the country the study of transportation and of traffic. He strongly supported the movement for traffic safety education in all schools and of studies that gave the pupil an appreciation of transportation at an early age, with a proper development of this subject through the advanced studies.

Dr. Claxton becomes Provost of the University of Alabama, located in a State which stands at the bottom of the list in automotive ownership. It is to be hoped that he will avail himself of his automotive knowledge as an aid in promoting education in that State. Also it is hoped that his official successor will continue the educational work he so well began.

## A Good Man for a Good Job

THE Society of Automotive Engineers is to be complimented upon being able to secure so excellent a man as Dr. H. C. Dickinson of the Bureau of Standards to act as manager of its new research department. There are few men with such a fund of information or so keen an appreciation of the value of research, and especially of fundamentals upon which all sound research work must be based.

It is to be hoped that the industry will lend its hearty co-operation in formulating and carrying through the research program decided upon, for the success of the whole venture is dependent upon a readiness to co-operate. In so doing what is given will be repaid a thousand fold in returns ultimately received.

Much commercial development work is now wrongly termed research. Such work is important but is to a large extent outside the field of activity to be fostered by the S. A. E. Sound development is, however, based upon sound fundamentals, and there is real need for gathering and disseminating the fundamental information which is to be sought in the new undertaking.

# Future Sales Prospect Brightens

## Hot Weather Decline Is Not Significant

### Better Business in Farm States Probable With New Harvests —Conditions Sound

By JAMES C. DALTON

NEW YORK, Aug. 1—The inevitable summer slump in the sale of automobiles has begun in scattered sections of the country and will be reflected in curtailed factory operations. The surprising feature of the situation is not that the slump has come, but that it has been delayed so long. Seldom, if ever before, have July sales compared so favorably with those of preceding months. In many cities they surpassed the June totals, which probably is unprecedented.

A few of the factories have orders on hand which will keep them going at the present pace through August, and dealers in the most popular lines are several weeks behind on deliveries. Ford proposes the largest output in his history for August. In few cases have sales dropped back to the levels of May.

The future is in the lap of the gods. After periods of prolonged depression predictions are unsafe, but there is every present indication that there will be a revival in the automotive industry by mid-September. It will not be a boom, and that is fortunate, for most business men have learned to their sorrow that a period of unexampled prosperity is inevitably followed by a period of unexampled depression.

**See Substantial Revival**

There are many reasons to believe, however, that the revival will be of substantial proportions and that sales will steadily increase in volume except for periodical depressions in the curve. Motor car sales in the future will depend more than in the past on general business conditions. Fundamentally, conditions are sounder than they have been in a year and a half.

Railroads and steel are barometers of general conditions. The carriers are doing better and the $500,000,000 they soon will receive from the Government is provided with the distinct understanding that the major portion of it will be used in the purchase of needed supplies. This will give added impetus to the steel and iron trade which already shows slight improvement with lower prices.

Analysis of automobile sales for the first half of the year shows that they have been chiefly in the industrial states. There probably will be a falling off in these states for the last six months, but there is substantial reason to hope that this decline will be more than counterbalanced by increased business in the great agricultural areas.

As a matter of fact, the outlook for the farmer is brighter than it has been since the collapse in the prices of farm products. He has been thoroughly "liquidated," but the sharpest edge of his grouch against the world has worn off. He is approaching a frame of mind where he will be willing to buy.

Crops of all kinds promise well and further declines in prices to the farmer are highly unlikely. Because of the general drought in Europe export demand is certain to be larger than it has been in many months. Exports of grain the first five months of this year were 60 per cent greater than for the same period in 1920 and were equal to a whole year's exports in the pre-war period. Exports of dairy products in 1920 were eight times as great as in pre-war years.

Increasing farm operations have relieved unemployment in many of the agricultural states. Except in the South, the unfavorable balance between agricultural and manufacturing districts is disappearing. Full harvests, plenty of farm work and substantial wage payments are stimulating business in Kansas and other early wheat states. Nothing resembling normal business can be expected in the farm states in the fall, but there will be a marked improvement in Kansas, Nebraska, Iowa, Missouri, Minnesota and the Dakotas.

**South Gains for Fall**

There will be some improvement in the South, but it will not be so marked. Cotton prices must recover sharply before sales in this section show much gain. Little improvement can be expected in the stock-raising, mining and lumbering states, although they undoubtedly have seen the worst of their depression. Fall probably will bring a strong upward trend in wool prices.

California continues, generally speaking, to offer the least sales resistance, but there are indications it is reaching the liquidating point. Other sections which offer fair promise for sales are New England, with the exception of Connecticut, New York, Pennsylvania, Indiana, Wisconsin and Chicago. May sales of general merchandise also were good in Arizona, Maryland, Nevada, some parts of Texas, West Virginia and Wyoming. There are some bright spots in almost every state, even in the South, which can be studied with advantage by sales managers.

The long swing of credit conditions will be toward further easing, but the season for crop moving is approaching and this seasonal demand upon bank resources will have tendency to tighten loans temporarily except in the agricultural districts. When the new crops

(*Continued on page* 244)

## Reserve Bank Lauds Trade's Initiative

### Cleveland Financial Institution in Statement Pays Compliment to Automotive Industry

CLEVELAND, Aug. 3—After stating that certain interests are holding business improvement back by failing to reduce living costs, the Fourth Federal Reserve Bank of this city pays a compliment to the automobile industry for reducing prices.

"It looks as if we are traveling in a helpless circle," reads the bank statement, "but the action of certain automobile makers in the recent past casts considerable light on the subject. Instead of hanging back and complaining that the other fellow was to blame, they reduced the prices of their products and convinced prospective buyers that they meant business. The theory that the man who has nerve enough to cut his prices regardless of what others are doing will get the trade, was proven correct by the increase in orders. And this same theory could be used to good advantage in practically all lines which are responsible for the present high cost of living."

Continuing the report states that mid-season depression still has the upper hand in most lines of business. Business about holding its own appears to fit the situation.

There appears to be a little better feeling in the passenger automobile line as compared to last month, and some good effects have resulted from the many price cuts. Some improvement is noticeable in the country districts where business has been very quiet for some time past.

The market for motor trucks is reported somewhat firmer. One large truck manufacturer reports sales as running a trifle over 50 per cent of last year.

**Atlanta Is Optimistic**

ATLANTA, GA., Aug. 3—Business, industrial and economic conditions in the southeast are more nearly normal today than they have been at any time since the armistice, and business generally is on a sounder basis, according to the monthly report of the Federal Reserve Bank of Atlanta, published the latter part of July, and covering general business conditions throughout the sixth Federal Reserve district.

Investigation of the records of licenses issued during July and of transfers of licenses, at the office of the Secretary of State in Atlanta, indicates that auto-

(*Continued on page* 244)

# Bill Calls for Federal Motor Tax

## Measure Carries Out Treasury's Proposal

### N. J. Representative Also Considers Reciprocal Proposals of N. A. C. C. and the A. A. A.

WASHINGTON, Aug. 2—Congressman Appleby, of New Jersey, has introduced a bill providing for a special license tax on automobiles and for a Federal license tax for motorists. The broad principle of his bill is in line with the proposal of the Treasury Department that a Federal license tax should be imposed as a part of the internal revenue bill. A reciprocal feature would carry out the principles for which the National Automobile Chamber of Commerce and the American Automobile Association and other automobile organizations have sought in a legislative manner.

**No Estimate Made**

In an interview with AUTOMOTIVE INDUSTRIES, Congressman Appleby today said that he had not estimated the probable revenue that would accrue from the license tax. He appeared before the House Committee on Ways and Means and explained his bill today.

Ninety per cent of the revenue derived from the licenses would go to the Federal Government and 10 per cent to the State. The rate as proposed by the Appleby bill would be forty cents per horse-power or a fraction thereof in the case of all vehicles having pneumatic tires, with a minimum charge of $5 for any motor vehicle.

For each motor vehicle equipped with solid tires and having a rated carrying capacity of not more than one ton, the rate would be $10, and $10 for each additional ton up to 7 tons, when the Federal rate would be $70. Motorcycles would be obliged to pay $3 per year, with an additional tax of $1.50 for each side-car.

Manufacturers of or dealers in motor vehicles other than motorcycles would be obliged to pay $3 for each registration tag, and registration tags would be interchangeable among the cars owned or used by such manufacturers or dealers during the current year for which the tax is issued, and would be allowed to be used only on new vehicles being brought under their own power from a factory to a dealer.

It is further provided that "no such dealers' tags shall be used on any car employed in transportation for hire or livery business. For each registration tax issued a dealer in motorcycles, $1.50, such tags to be interchangeable as in case of dealers in other motor vehicles. For each rubber-tired vehicle with a carrying capacity of one ton or less, trailed or propelled by any motor vehicle on which a Federal license is required to be displayed, $5; and $5 additional for each additional ton of carrying capacity or fraction thereof."

It is significant to note that the Appleby bill provides that the charges which it prescribes shall be for the twelve months period, "and shall in no way conflict or interfere with the license fees imposed by the respective States."

The administration of this proposed Act would be vested in the Bureau of Public Roads, after authority had been conferred upon it to negotiate with motor commissioners of the various States. The penalizing provisions of the bill call for a fine of not less than $50 nor more than $200, when any person operates an automobile without a Federal license. A Federal license is not obtainable until the State authorities have been convinced that the applicant for a license

(*Continued on page* 246)

## Staff of Class Journal Bids Sherman 'Au Revoir'

NEW YORK, July 28.—The staff of the Class Journal Co. gave a farewell luncheon at the Woodstock to-day to Ray W. Sherman, executive editor, who has resigned to become merchandising director of the Automotive Equipment Association. Sherman was presented with a handsome watch as a mark of esteem.

David Beecroft, directing editor of the Class Journal publications, presided. He praised highly the work done by Sherman in building up Motor World, with which he was connected for more than seven years. An address of similar purport was made by H. M. Swetland, president of the United Publishers Corp. and the Class Journal Co.

The presentation of the watch was made by Neal G. Adair, editor of Motor World.

Sherman will leave for Chicago tomorrow with his family to take up his new work immediately.

## 500 Buy Durant Stock in Lansing Territory

LANSING, MICH., Aug. 1—More than 500 persons in Lansing and vicinity have purchased stock in the Durant Motors, Inc. Stock sales have exceeded 6,000 shares.

This was announced Thursday morning by G. N. Murchey & Co., local Durant representatives. Most purchases have been in 10, 15 and 20 share lots, Glenn Murchey stated Thursday. The recent statement by the corporation that no more than 20 shares may be purchased at one time on the Durant partial payment plan has not apparently retarded sales.

## Bosch Magneto Head in U.S. to Fight Sale

### Otto Heins Here to Press Suit to Have Auction by Palmer Declared Void

NEW YORK, Aug. 1.—Otto Heins, former president of the Bosch Magneto Co., has arrived in this country from Germany to press his suit to have the sale of that property declared void. It recently was charged that A. Mitchell Palmer as alien property custodian showed undue favoritism to the present owners in the sale of the assets at auction.

Heins is represented by his attorney, Harvey P. Andrews of this city, who also is acting for several other German interests which are seeking the return of the property they formerly owned. Associated with him in this work are Clarence D. Miller, secretary of the Republican National committee and John Thomas Taylor, head of the Washington office of the American Legion, according to a statement by Andrews. Andrews has had much correspondence with the Republican senators and representatives who are members of the Foreign Relations committees of the two houses of Congress. Andrews himself has been prominent in Republican politics in this city.

Heins, who is a German citizen but is said never to have been declared an enemy alien, returned to Germany early in 1920, having been reduced from the status of a millionaire almost to that of a pauper. He has completed the reorganization of his business interests in Germany and has visited England, France and other countries. He now has come to the United States to make a strong effort to regain control of the company now known as the American Bosch Magneto Corp.

**Will Go Into Business**

Regardless of the success of his suit, Heins intends to go into business in competition with the American Bosch Magneto Corp., according to Andrews, "and expects to surpass them all in the manufacture of magnetos." His attorney added that he expects to file patents very soon and will manufacture a new spark plug and lighting system.

The action started against Palmer on behalf of Heins over the sale of the Bosch Magneto Co. alleges fraud and demands that the sale be declared null and void. It is charged that Palmer sold the property to Martin E. Kern, a personal friend, for $4,500,000, although it was worth $12,000,000.

(*Continued on page* 245)

# Many Resignations Follow Goodyear Cut

## Sweeping Salary Reductions Cause Break in Personnel—Budget System in Force

AKRON, Aug. 1—With all office and factory departments of the Goodyear Tire & Rubber Co. placed on a budget system effective Aug. 1 under the new financial control of the company, sweeping salary reductions have been made in the offices in addition to reductions in office personnel. In order to keep each department within its respective budget, many departments have cut personnel over 10 per cent, while all departments have reduced salaries from 10 per cent to 20 per cent under the budget paring.

The readjustment of office personnel at Goodyear has resulted in the resignations this week of some of the company's oldest officials and employees, including George Rogers, in charge of credits and collections, who has been with Goodyear for 20 years. He was one of the first associates of F. A. Seiberling when Goodyear, then two years old, was struggling for a foothold in the rubber industry.

### Assistant Treasurer Out

Other resignations announced include those of Harry Blackburn, assistant treasurer; Marshall Morris, formerly assistant general manager of the Goodyear Co. in California and more recently in charge of the new stock issues under the refinancing program; F. F. Dugan, in charge of sales personnel; Don Stevens, in charge of the factory labor department, and Dr. Clyde Leeper, medical officer in charge of the office dispensaries and nurses' staff.

W. D. Shilts, chairman of the board of control under the Seiberling régime, which was abolished when E. G. Wilmer succeeded Seiberling as president, has been assigned to install the budget system in Goodyear branches and to reduce expenses in all branch offices. C. C. Prather, manager of the products department, has been transferred to the sales department and assigned to Cincinnati as a general line salesman. C. T. Crudginton, editor of the *Goodyear Tire News*, and lately assigned to Council Bluffs, Iowa, as a general line salesman, has resigned and returned to the East.

### PLAN TRACTOR FIELD SHOW

MONMOUTH, ILL., Aug. 2—Tractor dealers are co-operating with the Chamber of Commerce, the farm bureau and local farmers in arranging a field demonstration Aug. 11. It is probable that the program will require two days and committees are completing outline of the field work.

To emphasize the value of power farming, teams of horses will be employed on adjoining fields to demonstrate the greater efficiency of the tractor operated machine.

### *GRAND CENTRAL PALACE SCENE OF 1922 SHOW IN NEW YORK*

NEW YORK, Aug. 2—Definite announcement is made by the National Automobile Chamber of Commerce that the annual New York show will be held at the Grand Central Palace Jan. 7-14. Earlier in the year it was supposed the Palace would not be available and Madison Square Garden was the next best location. Plans for converting the Palace into offices have been delayed, however, and the N. A. C. C. will be able to use it for the 1922 exposition which will be one of the most important ever held.

# Surplus Truck Sale Will Be Continued

WASHINGTON, Aug. 2.—All surplus property of the War Department scheduled for sale during August will be disposed of as previously arranged and unserviceable motor vehicles will be sold wherever possible. This policy was determined upon to-day following a conference between Director of Budget Dawes, Assistant Secretary of War Wainwright and Col. Hartshorn, Director of Sales, War Department. Director of the Budget agreed to the plan after learning that the War Department had canvassed other branches of the Government again and given them an opportunity to make requisition for surplus stocks held by the War Department, thus meeting the requirements of recent order from the Director of the Budget. This agreement between Government officials, now applicable for August only, is expected to be extended and other stocks probably will be sold when it is shown that other departments have been given opportunity to make requisition on War Department material.

# Several Changes Made in Personnel of G. M.

NEW YORK, Aug. 1.—General Motors Corp. announces the following assignment of duties and changes in personnel in the central office, Detroit:

James McEvoy has been appointed to the Advisory Staff, in charge of legal matters under the general counsel. J. G. Stevenson will be associated with McEvoy in legal matters.

A. C. Anderson, assistant comptroller, will be in charge of matters relating to insurance.

C. E. Stowe, assistant treasurer, will be in charge of matters relating to employees' fidelity bonds.

H. W. Webster, of the treasurer's department will be in charge of matters relating to taxes other than Federal taxes.

L. B. Robertson, in charge of taxes and insurance, has resigned.

# Fisk Stockholders to Readjust Capital

## Will Change Par Value of Common Stock from $25 to No Par —Will Buy Federal

NEW YORK, Aug. 2—Stockholders of the Fisk Rubber Co. will meet Aug. 9 to act upon a readjustment of the capital stock and debt of the corporation and to change the par value of the common stock from $25 a share to no par. The proposals under the plan provide for the creation of bonds without limitation on maturity and the creation of a class of stock with voting rights superior to any now outstanding. In addition, authorization will be asked for the creation of one or more mortgages to secure the bonds. Another proposal is to acquire the assets and the liabilities of the Federal Rubber Co. and the Ninigret Co.

The Fisk Rubber Co. is controlled by John N. Willys personally and not by the corporations of which he is the head. The Fisk company in 1915 acquired control of the Federal Rubber Mfg. Co., which was succeeded by the Federal Rubber Co. It owns $2,550,000 of the $5,000,000 common stock of the Federal company. The Ninigret company is a Rhode Island corporation with a capital of $550,000, with mills at Westerly in which all kinds of textile fabrics, including automobile tire fabrics, are manufactured.

### $8,500,000 from Surplus

In a letter to Fisk stockholders outlining the situation, it is stated that inventory adjustments resulted in a deduction of about $8,500,000 from the surplus accounts, so that the balance sheet now shows a deficit. Thus far this year Fisk has accepted nearly two-thirds of the rubber and fabric for which it was committed. While prospects for earnings and for a substantial reduction of the debt are excellent, Fisk and Federal will remain dependent upon bank loans for a large amount of working capital.

The plan calls for a bond issue to the amount of $10,000,000. Stockholders in the Federal Rubber would receive first preferred stock of Fisk, share for share, and in addition 58 2/3c. a share as a dividend adjustment. Holders of Ninigret stock would receive in exchange common stock of Fisk.

### WAINWRIGHT RUNNING AT TOP

CONNERSVILLE, IND., Aug. 3—The Wainwright Engineering Corp. is running its plant at full capacity on the day shift and 50 per cent at night, turning out 3600 pistons a day, chiefly for the jobbing trade.

John D. Carmody, for the past seven years district manager for the Champion Spark Plug Co. has been appointed Pacific Coast manager for the Wainwright company, with headquarters at San Francisco.

# Interlocking Cord Receiver to Go Soon

## If Stockholders Raise $20,000 Fund Receivership Will End in 30 Days

AKRON, Aug. 3—The receivership of the Interlocking Cord Tire Co., of Akron and Mogadore, will be lifted within 30 days, conditional upon the raising among stockholders of a fund of $20,000 to pay part of the company's claims in cash and to make a 15 per cent payment on the balance, according to an agreement entered into by officials of the company with receiver Elihu Harpham and Judge W. J. Ahern of Common Pleas Court.

The receivership was created last January upon indictment of officers of the company for alleged violation of the Ohio Blue Sky Laws. New officers elected since then are Edward Kohl, president; W. B. Smith, vice-president; R. E. Cartledge, treasurer, and R. A. Rukamp, secretary.

Claims against the company total approximately $80,000, including general claims of $35,000, preferred accounts of $45,000, work and labor claims of $1,300, and attorney and receiver fees of $12,500, in addition to $1,200 owed the Ohio Industrial Commission and $5,000 owed the Government in excise tax and penalties. Under the agreement entered into a mortgage on the company's property will be executed and delivered to the Ohio Savings & Trust Co. to secure these claims. Stockholders will be asked to raise $20,000 to make full cash payment of the claims of the Government, Ohio Industrial Commission, attorneys and receiver, and the work and labor items, and also to make a 15 per cent payment on the $60,000 balance. The preferred balance is to be paid in one year, and the balance due on general claims will be payable in full within two years.

Stockholders already have paid in over $15,000 towards the fund, which will mean lifting of the receivership. The company expects to get back into production with 30 days, with the Akron Engineering Co. handling all production. Suits filed by the receiver for collection of nearly $200,000 in unpaid stock subscriptions will not be prosecuted for the time being, pending the lifting of the receivership.

The indictments against former officers of the company are still alive in the Common Pleas Court of Akron.

### WINTHER CHANGES NAME

DOVER, DEL., Aug. 3.—The Winther Motor Truck Co. has filed a certificate changing its name to Winther Motors, Inc., and announcing that its capital has been increased from $22,000,000 to $61,000,000. The Kenosha Wheel & Axle Co. and the Marwin Truck Co. recently were consolidated with the Winther company.

### *JIMMY MURPHY FACED DEATH IN PRACTICE BEFORE GRAND PRIX*

NEW YORK, Aug. 1—Friends of Jimmy Murphy, who won the French Grand Prix at Le Mans in a Duesenberg car on July 25, are convinced he is a favorite of fortune. They are talking about his remarkable escape from injury in practice prior to the race when his car turned over while he was trying to avoid running down a horse which had strayed on the road. Louis Inghibert, who was serving as mechanician, was taken to a hospital with three broken ribs and was unable to take part in the race, but Murphy escaped without a scratch and his car was not damaged.

# Farmers and Labor Open Fight Against New Roads

TOLEDO, Aug. 3—Organized farmers and labor of Ohio have begun a fight against the carrying out of the road construction contracts let by the State Highway Department, which provide for the building of nearly 100 miles of new highway with an expenditure of nearly $3,000,000. The contracts have had included in their provisions an agreement that any lowering of freight rates will result to the benefit of the state.

But even though the contracts place the cost per mile about $36,000 as an average for all kinds of improved roads, the labor organizations say that that figure does not represent the decrease in wages taken by labor this summer and the farmers declare that under any circumstances the road building at that cost must await the return to normal. They point out that the same roads were built before the war for $10,000 a mile.

It is doubtful whether the road-building campaign will be interfered with this summer, as the contracts have been legally let. However, the result of the agitation may be to suspend contemplated projects next summer.

### CANADA'S EXPORTS INCREASE

OTTAWA, ONT., Aug. 3—Canadian motor cars, chassis and parts exported to Australia during the fiscal year 1919-1920 amounted to a value of $2,308,360 an increase of $372,535 over the figures for the year previous, thus giving Canada second place in the list. America being first and United Kingdom third.

### MAINE AFTER HEAVY TRUCKS

BOSTON, MASS., Aug. 3—Maine has started a campaign to rule off the highways trucks exceeding the 18,000 pound limit law passed by the last legislature. It will particularly affect commercial vehicles carrying loads from Massachusetts into Maine, if the campaign is effective.

# Studebaker Income Shows Healthy Gain

## Net Profits Three Months Ending June 30 Come to $4,270,547 Report Says

SOUTH BEND, IND., Aug. 1—The Studebaker Corp. for the three months ended June 30 reports net income of $4,270,547 after all charges and reserves for inventory adjustment. After payment of preferred dividends this was equivalent to $6.83 a share on the outstanding common. In the first three months of the year the company reported net profits of $2,210,577.

Net sales for the second quarter of 1921 were $33,059,834, as compared with $22,249,299 for the same period in 1920. Total assets are $96,880,381, including trade name and good will, which are valued at $19,807,277. Inventories amount to $20,926,304, cash to $6,376,030, sight drafts to $3,318,068 and accounts and notes receivable to $5,879,734.

The company has no notes payable and accounts payable amount to only $3,892,413. Miscellaneous liabilities are listed at $3,165,772 and the reserve for Federal taxes at $2,617,023. There is a special surplus account of $3,645,000 and the regular surplus stands at $13,760,000.

Production of cars in the quarter ended June 30 reached 8498, as compared with 4811 in the same quarter last year.

The directors have declared the regular quarterly dividends on the preferred and common stocks.

# Threefold Demand For Endurance Race Meets

SAN FRANCISCO, CAL., Aug. 2—Public demand, met more than half way by the desire of the manufacturer and the distributor, seems to be bringing back the old-time demonstration and endurance races, designed to show exactly what each car will do. The object of these races, of course, is twofold, first to bring home to the public mind the performing ability of the automobile, especially the stock car, and, second, stimulate improvements in construction and mechanical design. On the Pacific coast there also is manifest an appreciable revival in interest in the racing game, and large crowds greeted the finishes of the races at Tacoma, Seattle, and Reno this year.

### TIMKEN LAYS MEN OFF

COLUMBUS, Aug. 2—A slight depression in business has caused a lay-off of a number of men at the Columbus plant of the Timken Roller Bearing Co. Since the plant resumed operations gradual increase in the working force has been made until approximately 400 men were employed. The depression is expected to be temporary and men will be put back at work as soon as things improve.

# Dr. Dickinson Heads Research Bureau

## Quits Work with Bureau of Standards to Assume New Duties with S. A. E.

NEW YORK, Aug. 1—Dr. H. C. Dickinson, who has been assisting Dr. S. W. Stratton, Director of the Bureau of Standards, Washington, D. C., has been engaged by the Society of Automotive Engineers to manage the research department which was created by the Council of the society at its February meeting in Chicago. Dr. Dickinson will assume his new duties on Sept. 1, after which date he will be located in this city.

For some months the council of the society has been carrying on its efforts to secure Dr. Dickinson, but his work in connection with the Bureau of Standards has been of such importance that it was only after repeated presentations of the case that Dr. Stratton consented to grant the necessary release. Dr. Dickinson's work with the Bureau of Standards has been very closely connected with the automotive industries in that this phase of research work in the bureau has for some years come directly under his control. No one better qualified to handle the research program of the society could have been secured. He has a mind peculiarly trained for research work. His coming with the S. A. E. assures the success of the research program.

**Presents His Views**

In the August issue of the *Journal of the Society of Automotive Engineers*, Dr. Dickinson presents some of his views on the subject of research. He classes research under three heads:

**1—Explorational research.**
**2—Intensive research.**
**3—Developmental research.**

Explorational research.—This research deals with the fundamental analysis of problems through the study of available literature, and of the technical and economic condition involved.

Intensive research.—This includes the major part of research usually accomplished in experimental research laboratories. It requires considerable laboratory equipment.

Developmental research.—Developmental research involves the application of experimental facts and principles to the solution of practical problems. It seldom leads to the highest efficiency and never to a knowledge of principles. It is the method of evolution, as well as that by which practically all of the mechanical arts have received their initial development.

Dr. Dickinson believes the aims of the research department of the Society of Automotive Engineers for the immediate future are to encourage and secure as far as possible a more systematic survey of the research field as applied to our industry, to bring to the attention of the various laboratories such problems as appear in most pressing need of solution or of increased attention, and to secure to the greatest extent feasible a more general interchange of information between the various laboratories and individual investigators.

In carrying out this work, Dr. Dickinson believes it necessary to draw a sharp line of distinction between developmental research and fundamental or intensive research. Developmental research must be considered of a private and confidential nature; whereas intensive research is distinctly of more value, if mutually shared by the members of the industry.

Dr. Dickinson proposes to use existing laboratories to the fullest extent. In this work there are three types of laboratories to be utilized:

**1—Corporation laboratories.**
**2—Educational institution laboratories.**
**3—Government laboratories.**

Each should be occupied with the kind of problems with which it is best fitted to deal. There are many corporation or industrial laboratories that have excellent material facilities, and able men, but are doing little that can properly be classified as research work.

The laboratories of educational institutions require a closer contact with the problems and requirements of industry. The Government laboratories have inadequate contact with industries and do not always appreciate the relative importance of various problems.

### *FIGHT ON GEORGIA GAS TAX WON BY AUTOMOBILE DEALERS*

ATLANTA, GA., Aug. 2.—Contrary to expectations the bill before the Georgia State Legislature providing for a one cent per gallon retail sales tax on gasoline has been defeated. Automobile dealers bitterly opposed the bill, not so much because of the additional one cent per gallon they would have to add to the price of gas, but because of the extra amount of bookkeeping such a law would compel.

### FORM DISCOUNT COMPANY

QUINCY, ILL., Aug. 3—The General Discount Corp. has been issued incorporation papers in Springfield with a capital stock of $225,000. Rolland M. Wagner, Arnold V. Scott and C. B. Parks are incorporators.

The firm will make loans from its capital upon automobiles, deal in automobile dealers' notes, conduct rediscount business on contracts and handle mortgages. Scott, the manager, has been associated with the State Savings Loan & Trust Co., but is resigning to devote his entire time to the new organization. A. E. Gibson will be fiscal agent for the company.

# 45,000 Less Employed in Akron Tire Plants

## Records Show Drop from 72,000 in Spring of 1920 to 27,000 with Production 80%

AKRON, Aug. 1—Employment records from the nine major rubber companies in Akron show that between 26,000 and 27,000 day workers and tire builders now are being employed as compared with about 72,000 in the same factories during the peak months of the tire industry in the spring of 1920. The low ebb of employment is reported to have been slightly under 19,000 factory workers in December of last year and January of this year. The records apply only to day workers and not to office employees or salaried factory employees.

The employment figures are regarded as significant in view of the fact that these same nine rubber companies are producing over 80 per cent of their peak production of 1920. This indicates over 80 per cent of peak production with 36 per cent of peak employees, showing a high percentage of increased efficiency both individual and collective among factory workers.

For example, the Goodyear company when it had a peak production of 31,181 tires daily had nearly 33,000 employees on its payroll, including its office personnel. To-day Goodyear is producing 28,640 tires with about 13,000 employees.

The employment figures cover the Goodyear, Goodrich, Firestone, Miller, Kelly-Springfield, Swinehart, Star, General and Mohawk factories in Akron.

# Freight Barge Fleet to be Operated by Ford

NEW YORK, Aug. 1—Henry Ford is preparing to put into operation at an early date a fleet of freight barges to transport automobile material from Detroit, via the Erie Canal, to Troy and this city. The barges have been planned by Ford, and will be propelled by marine gas engines. They will be 150 feet in length and 20 feet in width, having a capacity for 1000 tons of freight.

The barge shipments, in addition to supplying the Kearney plant with material, will be used for shipping motor parts and freight to the Ford plant to be built at Troy. Work on the large power house there is now under way, but the factory will not be ready for operation until nearly a year hence.

### TRACTOR SALES GROWING

INDIANAPOLIS, Aug. 3—Tractor business in this territory is picking up materially, branch managers here declare. They say the farmer is fast recovering from the shock of lower grain and live stock prices and is returning to the markets in a buying mood. Dealers here do not believe the price decreases will have merely a temporary effect in stimulating sales.

# Germany Goes After South African Trade

## Post-War Models Arrive in Johannesburg—Demonstrate Benz Models

JOHANNESBURG, June 28 (By Mail)—The first tank steamer carrying oil fuel in bulk has paid a visit to the newly completed storage tanks at Durban, Natal. For a considerable time the policy of importing oil fuel in bulk has been advocated and at several other ports the construction of large tanks now is being proceeded with.

More post-war German models have arrived. The Benz cars and trucks have been demonstrated in various parts of the country and consignments of Adler models are expected. Germany intends to capture part of the South African automobile trade and efforts are being made in different centers to popularize German automobiles.

The Vacuum Oil Co. has announced a reduction of two shillings current rate of exchange (40 cents) per case of 8 gallons in the wholesale price of petrol. This cut in price was not wholly unexpected but was welcome nevertheless. A consignment of power alcohol which is compounded with other substances and marketed under the name of Natalite, has been sent to England for demonstration and experimental purposes. It has been on the South African market for about four years and was widely used during the petrol shortage. The price is considerably less than that of petrol and the results given are considered excellent. The verdict of the English automobile bodies is being awaited with interest.

A number of price reductions in cars has been announced during this month, and Studebaker models are selling at very low prices indeed. The "Big Six" is now obtainable at $2,887, whereas only six months ago it was selling for $3,562. With these price reductions ruling the sales of English and Continental cars have become slower, as no reductions worth mentioning, with the exception of the Vauxhall, have been made.

Ralph Dort of the Dort Motor Car Co., has been touring S. A. studying trade conditions. This is the first occasion on which a principal of a large American motor manufacturing firm has visited this country. Dort motor cars are few and far between in Africa, but after Mr. Dort's visit it is expected agencies will be fixed up in various parts of the country.

The trade position still looks hopeful for the second half of the year, and the results given by the motor sections at the different Agricultural Shows held in the country districts give evidence that the farming community are open to buy automobiles if the territory is properly combed out. More intensive sales methods are being used with the result that in the spring the car business ought to be brighter.

### *FRANKLIN EMPLOYEES DRINK 2,000 PINTS OF MILK EVERY DAY*

SYRACUSE, Aug. 1—Employees of the Franklin Automobile Co. have become the champion milk drinkers of the city. The company has installed a refrigerating system and sells the milk at any time of the day. On one hot day recently 2500 pint bottles were sold and the usual daily consumption is 2000 pints. The proceeds from the sale of the milk are used for the support of the Franklin Employees band, numbering forty pieces.

## Company Is Organized to Take Over Root Firm

SPRINGFIELD, OHIO, Aug. 3—With a capital of $300,000, the Automotive Supply Co. was organized to-day to take care of the wholesale business of the H. G. Root Co. J. L. Zismer was elected president and treasurer and L. W. Peaz, secretary. Besides these men the directors are H. G. Root, general manager of the Westcott Motor Car Co., J. Stanley Weigel and W. C. Webster. The new company will take over the wholesale business of the H. G. Root Co. Aug. 1.

Speaking of the new company Zismer said: "We will carry all kinds of auto supplies. Retail stand will be maintained as usual. We will operate the wholesale business in Springfield and Columbus and will develop this wholesale automotive supply business in this territory."

## Braender Rubber Has Reorganization Plan

NEW YORK, Aug. 2—The creditors' committee for the Braender Rubber & Tire Co. of Rutherford, N. J., which was thrown into bankruptcy in May, has worked out a plan for reorganization which has been submitted to creditors. It calls for the formation of a new company to take over the assets of the old and under the plan all creditors except the Braender family would take first preferred stock at par, equal to their claims. Claims less than $100 would be paid in cash. Management and control of the business would be vested exclusively in the first preferred stock until all this class of stock had been retired out of earned surplus. By vote of holders of two-thirds of this stock the company could be liquidated at any time.

The total liabilities of the company are $1,028,638. They are divided as follows: Federal taxes and wage claims, $90,819; claims of creditors secured by collateral and indorsements of members of the Braender family, $190,606; claims of general unsecured creditors, $202,481; claims of members of the Braender family, $369,731; claims for damages by unsecured contract creditors for undelivered merchandise, $175,000.

# Italy Building New Motor Car Speedway

## Hope to Have Brescia Track Completed for Races September 4-11

MILAN, ITALY, July 20 (By Mail)—That Italy is determined to maintain the position it has occupied in the past in automobile road racing is established by the building of a special road-racing circuit in the form of an 11-mile triangle close to the town of Brescia where Italy's greatest road races have taken place in the past. The Automobile Club of Milan, with the aid of the citizens of Brescia will have this 11-mile racing triangle completed in time for the week of September 4-11, when a three-day program of motor races supplemented by an aviation program will take place.

The new Brescia circuit makes use of approximately 10 miles of existing highways and includes 1 mile of new highway built to avoid going through the town of Montichiari, which is the only town on the circuit. Two sides of the triangle are approximately 3½ miles straightaway. The new roadway being built over the entire 11 miles has a minimum width of 26 ft. and a maximum of 32½ ft. It is being macadamized and tarred throughout the complete length. Curves are being specially prepared for speed. One parabolic curve connecting the two 3½-mile straightaway sides is expected to admit of very high speed.

A complete equipment of grandstands, restaurants, press-stands with telegraph and telephone installations is being installed.

The program for the September week opens with the Grand Prize September 4, a 3-liter classification of thirty laps or approximately 324 miles.

On September 8 there will be the Grand Prize for light cars, 1½-liter piston displacement at 216 miles. On this day kilometer trials for all classifications will take place.

September 11 will be given over to the Grand Prize for gentlemen drivers in which engines of any capacity over 2 liters will be admitted. There will be three classifications in this event.

### NAME MONITOR RECEIVER

COLUMBUS, Aug. 2—Upon the application of the J. E. McNally Lumber Co. who held a note against the company, Judge Rogers in the Franklin County Courts has named Ernest W. Pavy, receiver for the Monitor Motor Car Co. under a $50,000 bond. It is claimed that the company has a considerable amount of finished cars, partly finished cars and materials on hand and pressing creditors threaten a dissipation of the assets. The receiver has announced that the assets aggregate $400,000 and the liabilities, $190,000. Operations at the plant, outside of furnishing service, have been suspended.

# Big Labor Efficiency Increase for Willys

## Production With 7700 Men 50 Cars Greater Than With 13,000 Year Ago

TOLEDO, Aug. 2—That the Willys-Overland plant is getting greater production today with 5,000 less employes than it did a year ago was the finding of President John N. Willys while here on a visit to the factory this last week.

Willys sent out some interesting information to the stockholders as a report of how he finds things here.

He said the company with 7,700 employes now is producing 50 cars more per day than a year ago when there were 13,000 men at work.

"You will be interested to learn that our business in the last two months has been very close to normal. June and July have averaged between 10,000 and 11,000 cars a month," the letter sent to all shareholders said.

"Since March I have talked to more than 2,500 of our dealers and distributors and I am pleased to state that since then we have added more than 400 to our dealers' list.

"I think you will agree that is very good under the distressing business conditions, which have been general all of this year.

"For the past 10 days I have been studying every detail of the business here, and I find the whole organization working thoroughly in harmony under the direction of C. B. Wilson, vice-president in charge of operation.

"A great many economies have been made and we are going to make a great many more. For instance, last week we made approximately 550 cars a day. which is about 50 cars more than a year ago, and the total number of factory employes at present is 7,700 as compared to 13,000 a year ago.

"This shows an increase in efficiency that is very gratifying."

Following in line with the reported decrease due for this month in the working force at the Overland other Toledo subsidiary plants were planning cuts in their forces.

The Electric Auto-Lite Corporation plans on operating through August with very little reduction in its force of 1300 employes. Possibly 100 will be let out.

The Overland is reducing its force gradually paring off a few hundred each week.

This week the company shipped several boatloads of cars to Buffalo.

### DENY RUTENBER CLOSING

INDIANAPOLIS, Aug. 3—In denial of the rumors circulated to the effect that the Rutenber Motor Co., at Marion, Ind., had discontinued business, R. S. Bower, general manager of the company, stated that such rumors are absolutely false. He says the Rutenber Motor Company is doing as much business as the majority of the factories in Marion to-day, and that there has never been any ground for such statements. He said it was true that the company had sold their old factory to another company, but that they had immediately purchased another plant where they have since continued doing business.

## Preston Motors Brings on New Roadster Model

BIRMINGHAM, ALA, July 30—Preston Motors Corporation have recently brought out a roadster, a new model for 1922.

The roadster has the same chassis as the touring car, having a wheel base of 117 in., and the same standard units throughout that have featured the Premocar since it was first put on the market. The roadster has the same high, well-arched hood, streamline effect, with beveled edge and a sloping rear end, that makes its whole appearance quite attractive.

The seat is roomy and comfortable, and the doors are large. A noticeable feature is the rear compartment, which is unusually large. The lid lifts up and is held by side arms, uncovering a space large enough to carry a large size steamer trunk or all sorts of bags and baggage. The price of the roadster is the same as the touring model and production is now going on.

## Duesenberg Shipments Will Start September 1

INDIANAPOLIS, July 18—Deliveries to dealers who have been established in all parts of the country, will be begun Sept. 1 by the Duesenberg Automobile & Motor Co., Inc. Orders for more than 3,000 cars which will cost in excess of $12,000,000 now are on the books.

Factory production will be in charge of A. W. King, formerly production manager for the Buick Motor Co. and the Northway Motors Co., who recently returned from France where he reorganized the production system of the Berliet company.

The sales organization is being perfected by Harry W. Anderson, who has served as sales manager for Stutz, Templar and the Buda Co.

### U. S. PRAISES N. A. C. C. IN WAR

NEW YORK, Aug. 1—The National Automobile Chamber of Commerce has been awarded a certificate of merit by the War Department in recognition of loyalty, energy and efficiency in the performance of its war work, which materially advanced the war program.

### FORD TRACTOR CUTS FORCE

HAMILTON, Aug. 2—C. A. Anderson, manager of the Ford Tractor plant announces that all but 75 men employed in the factory will be laid off July 30 until Aug. 15. This means that 325 men have been laid off until that time. No explanation for the action was made.

# Brazil Invites U. S. to Tractor Trials

## Ministry Anxious for American Entries for Annual Meet at Praia Vermelha

NEW YORK, Aug. 3—The annual Brazilian tractor trials for 1921 will be held on Oct. 1 at Praia Vermelha, a suburb of the capital, Rio de Janeiro, under the auspices of the Brazilian Ministry of Agriculture. This information was contained in a cablegram from the ministry received to-day by EL AUTOMOVIL AMERICANO, the Spanish automotive publication of the Class Journal Co. Entries from American manufacturers are asked by the ministry which states that the trials will be similar to those held last year.

The 1920 competition was held early in October at Santa Cruz and Deodoro, also suburbs of the Brazilian capital, with entries of Twin-City, Allis-Chalmers, Monarch, Titan, Moline and Fiat tractors. A six-hour plowing match was held that was carefully observed by representatives of the ministry and a report was later made showing the cost and results as it applied to each entrant. The field chosen last year was not entirely suitable for satisfactory plowing as it had been deforested only a short time before the contest. Although to-day's cablegram did not mention this subject, from other correspondence it is believed the trials will be held this year in more suitable territory.

Conditions in Brazil, so far as they pertain to the automotive industry, are reported as showing much improvement, despite the fact that present exchange conditions make immediate business very difficult. Some American manufacturers, realizing that this condition is only temporary, have come to satisfactory arrangements with their Brazilian representatives and have made recent shipments of complete cars and trucks. Road building is continuing in Brazil and much new mileage is being gotten under way. The 107 kilometer road between Sao Paulo and Campinas, in the coffee country, has just been opened for traffic and is one of the numerous roads that are being put in first class condition.

### ACCESSORY MEN TO CONVENE

PHILADELPHIA, Aug. 1.—The Automobile Accessories branch of the National Hardware Association will hold its fourth annual meeting and exhibition on Young's pier at Atlantic City, Oct. 19-22.

### DENIES FREIGHT RATE CUT

NEW HAVEN, CONN., Aug. 1—E. J. Pearson, president of the New York, New Haven & Hartford Railroad, denied to-day that there would be a general reduction in freight rates to meet the keen competition offered by motor trucks.

# Detroit Production Gained in July

## Output Increased in Most Factories

### Some Propose Continuance of Present Schedules This Month —Sales Holding Well

DETROIT, Aug. 2.—Production in a majority of Detroit plants for July shows a general increase over June and in some of them schedules for August indicate a continuance of the present output. The Ford Motor Co. closed the month with a total production of 107,132, about 5 to 6 per cent of which was trucks. This was slightly under the schedule outlined, due to manufacturing conditions only. In August the company is adhering to its 109,000 schedule.

Studebaker is running to capacity. July production totaled 8100 in all models which is as many as the company can build. August will witness the same output. Unfilled orders under present schedules can't be brought down at all.

Buick is going to build 11,750 cars in August, which includes both the new four and the former models. This will be within 250 of the biggest month the company ever had. July production ran between 9000 and 10,000, which is big business.

Hudson-Essex in July ran at about 60 per cent of its 1920 business. This same rate in August will mean 75 per cent of its 1920 business. "Sales are holding up beautifully," is the factory statement and while conditions are admittedly peculiar the companies are confident of plenty of business ahead.

**Cadillac Running Well**

Cadillac business is running at the rate of 80 to 100 cars a day. Production in July was slowed somewhat owing to moving operations which are now completed with all equipment installed. The company will devote all of its labor in August to car production. The sales outlook is considered especially bright.

Maxwell and Chalmers produced 1085 and 257 respectively, in July. With Maxwell this represented an increase from 878 in June. Chalmers showed a falling off. Production in August will be based upon business conditions and will adhere to approximately the same schedule shown in July.

Packard business in July showed an increase in twin six sales, ascribed at the factory to the cut in prices. The single six business approximated that of June. Production will continue at the same rate in August. The factory reports little business in trucks.

Oldsmobile business ran at about 70 per cent of normal capacity. Production in August will be at about the same rate as in June and July.

Dort reports business in July as running at about 1500 cars. In making comparisons the company, through President Dort, declared business is running in excess of 1919 which it considers a busy year. The company declares business best in big industrial centers.

Hupp in July turned out 1925 cars, or 175 more than in June. The outlook for August is satisfactory and schedules will be continued along present lines. Columbia business in July approximated 60 per cent of normal, keeping up with the June rate.

**Improvement in Briscoe**

Briscoe reports a marked improvement in July sales. The plant ran at about 50 per cent of normal. Many dealers and distributors were taken on by the company in July. Liberty business bettered June by 25 per cent. The company's new sport car is making its appearance.

Paige reported July as its biggest month since April, about 1200 cars being produced, which represented a 40 per cent increase over June. The company looks for good business in August.

Saxon business in July ran 20 per cent better than June. The company's new line is making good headway and it reports greatly increased interest on the part of dealers. Wills-Lee is running along at the same rate reached following the introduction of the car to the trade. Sales are steady and good business is looked for in August.

## Larrabee-Deyo Makes New 1-Ton Truck Model

BINGHAMTON, N. Y., Aug 3—A 1-ton, six-speed model is the latest addition to the line of trucks made by the Larrabee-Deyo Motor Truck Co., this city. With this new model, the line now consists of 1½, 2½, 3½, and 5-ton sizes.

This new model is at present being tested out on the road. It has a speed of 55 m.p.h. with 2450 lbs. of dead weight. In a test recently made, the truck was driven from 2 m.p.h. to 30 m.p.h. within 50 ft.

Specifications include the following units: Continental 7-R engine; Brown-Lipe clutch and gearset; Gemmer steering gear; Fedder radiator; and Spicer universal joints in the rear and Thermoid in the front. Other equipment includes metal disk wheels; steel cowl, seat riser and back, with fore doors, all integral.

The wheelbase is 138 in., allowing for 9 ft. of loading space back of the driver's seat. This job complete with electric lights, starter, cab, windshield and express body will list for approximately $2,000. Tire equipment includes 34 by 5-in. cords.

## North Dakota Sales Dependent on Crops

### Distributors Expect Better Business but Improvement Will Be Slow

NEW YORK, Aug. 3.—With crop conditions fairly well understood, and the crops nearly matured, the automotive distributors of North Dakota are arriving at their estimates of the possible fall business in the sale of cars, trucks, and tractors, and also in the possibilities for business next spring.

North Dakota as an agricultural State is typical of those areas where business in all lines other than agriculture, is reflected almost directly in the condition of crops. As North Dakota did not profit during the war by large crops and war prices business in the State did not get far away from the crop.

Crop conditions in the State are in general a little better than a year ago. In the Southwestern part there is literally no crop, whereas a year ago they had some.

In the Minot area in the Northwest, with the exception of a local zone surrounding the city, crops are 50 per cent over a year ago. In the Devils Lake area in the central north, they are 25 per cent ahead of last year. In Grand Forks, representing the Northeast, they are as good as last year. In Fargo, representing the Southeast, they are about the same as last year. In general motor business throughout North Dakota during this fall and next spring will largely reflect these crop conditions.

**Three Questions Asked**

In a canvass made of automotive distributors in the cities of Fargo, Grand Forks, Devils Lake, and Minot, three questions were asked:

1—To what extent do you think the farmer will be a greater buyer of automobiles and tractors in the next twelve months than he has been in the past twelve?

2—How much improvement in the sale of automobiles to the agricultural community are you expecting during the coming fall?

3—Do you think the city and town population will constitute as good a market in the next twelve months as they have in the past twelve?

The replies may be summarized thus:

1.—The farmer's purchases next fall will pretty generally be reflected by his crop condition. In Minot, where crop conditions are good, distributors of low priced cars expect a greatly increased business over last fall. As the scale of prices increases a distributor does not expect a much greater business with far-

(*Continued on page* 247)

# Many Detroit Plants Planning New Models

## Ford Company Denies Story About New Car—Prices to Change Also

DETROIT, Aug. 2—Many of the factories in the Detroit district are planning new models for appearance in the late summer and early fall months, but the Ford Motor Co. will not be one of them. A statement by the Ford company to-day says:

"Our attention has been called to recent newspaper articles to the effect that there is to be a new model Ford car on the market Aug. 15 with change in design such as a ventilating windshield and one-man top. As we do not contemplate any such changes and there is no foundation to the rumors circulating in this connection, we have no hesitancy in making a denial of the report."

Columbia Motor Car Co. will present its 1922 models on Aug. 15. The new line will embody many new features and is designed to meet the demand for cars along sport lines. New prices will be announced in connection with the new line.

Liberty Motor Car Co. is bringing out a new sport model which will soon be ready for delivery. Prices will be announced when general delivery starts.

Maxwell will meet the demand for cars of greater wheelbase and generally improved appearance by changing its line to a larger vehicle. Necessary changes in equipment are now being made at the factory and by early fall the company will be in production on the new models solely.

# Atlanta Bank Predicts Good Business Future

(*Continued from page* 236)

mobile sales in this city and in the state at large are considerably less than they were in June. About 400 sales are shown in the city of Atlanta alone, this including trucks, passenger cars, used cars and used trucks, the total for the preceding month being much larger than this. Outside of Atlanta, and especially in the smaller towns, sales during July are also considerably less than June.

Tire sales in this section improved materially during July, in most cases sales for the month being reported in excess of the totals for July, 1920. The increase evidences an early return to pre-war conditions in the tire business. Most of the sales have been in the rural districts, especially in the peach, berry and melon belts, where the farmers and growers have experienced one of their most successful seasons in years. If the business continues as good the remainder of the season as it has the past two months the tire industry in this section, at least, will be on as firm a basis as at any time prior to the war.

### *WILLYS FULFILLS PROMISE, 10% OF BANK CLAIMS PAID AUG. 1*

NEW YORK, Aug. 3—Fulfilling the promise made a short time ago by John N. Willys that a part of the cash surplus of the Willys-Overland Co. would be used on Aug. 1 to make a substantial reduction in the corporation's bank indebtedness, 10 per cent of the bank claims were paid on that date. The obligations of the company to bankers approximate $20,000,000. The payment, therefore, was about $2,000,000. This will leave a substantial amount of cash on hand.

# Harper Bean Balances Show $600,000 Losses

LONDON, July 22 (*By Mail*)—The report and balance-sheet of Harper Bean, Inc., covering a period from its inception in November, 1919, to December, 1920, shows a loss for the period amounting to nearly $600,000, and this does not cover the depreciation which has taken place in the company's investments, which appear in the balance-sheet at cost.

The directors report that proposals will be submitted in due course to reduce the capital of the company by over $10,000,000. The issued capital is $30,000,000, but unpaid calls due from shareholders amount to over $5,500,000 and the directors say it is impossible to collect the bulk of it.

Harper Bean was registered on Nov. 7, 1919, to acquire all the shares in A. Harper Sons & Bean, Ltd., approximately 75 per cent of the shares in the Vulcan Motor & Engineering Co., Ltd., 51 per cent each of the ordinary shares in Swift of Coventry, Ltd., and the British Motor Trading Corporation, Ltd., and, with one exception, all the share capital of six other undertakings, and has since acquired 100,000 ordinary shares in the Birmingham Aluminum Casting Co., Ltd., at $15, and 196,898 shares in A. B. C. Motors Ltd.

Conroy, late of Willys-Overland, U. S. A., who became production organizer to the company, has recently started in London as a consulting engineer.

### BIG ORDER FROM FORD

SPRINGFIELD, OHIO, Aug. 3—Ford Motor Co. has placed an order with the Victor Rubber Co. for 200,000 rubber mats for delivery during the remainder of the year. According to announcement made to-night by President H. S. Berlin of the Victor Rubber Co., formerly of Akron, this order is in addition to one for 250,000 mats received from the Ford company early in the year.

The company turned out 900 cord tires yesterday, the largest output of cord tires in its history.

# 500,000 Spark Plugs Sold to Italy in Year

## Gasoline Selling for 80 Cents—Heavy Automotive Taxes Burdensome

WASHINGTON, Aug. 3—The estimated consumption of spark plugs in Italy for 1920 is 500,000 to 600,000, according to a report received from American Consul North Winship, Milan. Of the spark plugs sold in that market, about 90 per cent are of European manufacture and 10 per cent of American make. The importation of German makes has increased and is now estimated to be 60 per cent of the total market. Lire 3 to lire 6.50 is paid by jobbers for plugs, which are resold to dealers from lire 4.50 to lire 7.50.

According to figures published by the government tax bureau for 1920, there were in operation in Italy 25,000 private automobiles, 3,000 public passenger cars, 25,000 trucks and 15,000 motorcycles. These figures are exclusive of army trucks and those used by other government and municipal departments. The number of airplanes in use is about 500, all of European manufacture.

Owing to heavy taxes imposed by the Italian government on the operation of motor vehicles, high-powered and pleasure cars are being stored by a great many owners. Where the use of automobiles or trucks is essential, their number is reduced to the minimum. The sale of spark plugs consequently is diminished.

Spark plugs are classified for import as scientific instruments of precision and the customs duty is lire 125 (gold) per quintal (220 pounds). The rate of exchange on gold is fixed by the ministry of the Italian treasury.

# Prospects for Future Sales Appear Bright

(*Continued from page* 236)

come into the market, however, there will be additional liquidation of loans by farmers which will tend to make money more plentiful throughout the country.

General buying power in farming communities will depend largely upon the attitude of the bankers. Countless farmers would require the entire proceeds of their crops to meet their bank obligations and if the loans are called relentlessly they will have little left with which to make purchases.

Altogether, so far as the automotive industry is concerned, sales have been far better than any one dared hope in January, and there is every indication that they will go up again with the end of summer. It should not be forgotten that passenger car production for the second quarter this year was 87 per cent of the same period in 1920, which was one of the largest quarters.

# Rolls Royce Reduces Chassis Price $1250

## Cost Cuts in Production and Labor Responsible—Other Makes May Follow

LONDON, July 22 (By Mail)—The Rolls Royce Co. has reduced the sales price of its chassis by $1250 (normal exchange rate). The reason ascribed is reduced cost of production for labor and materials. The price now is $9,250. It is believed that this marks the end of the $10,000 chassis and that Lanchester, Napier and others will follow suit.

Opinion is fairly uniform that prices will have to fall below the new standards set by Rolls Royce before the demand for cars of this type returns with sufficient force to permit the full output of plants to be absorbed. With general industrial conditions settling down, however, it is believed manufacturers of these high grade cars will be able to work off some of the heavy stocks accumulated during the past nine months.

Several other price reductions have been announced in the past month. Charron-Laycock has reduced from $3125 to $2875; G. W. K. from $1750 to $1550; Hampton from $2300 to $2000; Sunbeam from $4650 to $4000; Warren-Lambert from $1925 to $1750; Waverley from $2625 to $2500; Anglo-American Ford from $900 to $825; Overland-Crossley from $1975 to $1925.

# All H. C. S. Prices Cut; Output to Be Reduced

INDIANAPOLIS, Aug. 1 — Effective to-day, prices on all models made by the H. C. S. Motor Car Co. are reduced $200 in price. The roadster and 4-passenger touring car are cut from $2,975 to $2,775, the coupe from $3,650 to $3,450 and the sedan from $3,850 to $3,650. Prices are f.o.b. factory. Prices were guaranteed until Aug. 1.

Coupled with the price reduction comes the statement that instead of producing nine or ten cars a day as at present, the plant output will be cut to five cars a day, which is the normal capacity.

Officers of the company say that under no circumstances will production be increased. They declare that the working force has been organized to make five cars a day and that nothing will be permitted to disarrange this program.

### HANSON MAKES FINAL CUTS

ATLANTA, Aug. 3—The Hanson Motor Company announces final 1921 price reductions on all its models, effective at once. Prices are f.o.b. Atlanta. Total reductions since Jan. 1 average $600. The latest cut brings the roadster and five-passenger touring car from $2,185 to $1,795; the five-passenger sport model and the seven-passenger touring car from $2,285 to $1,895; the sedan from $3,165 to $2,885 and the coupe to $2,775.

### *WEED CHAIN PATENT EXPIRES SOON, COMPANY HASN'T "BEEN ASLEEP"*

NEW YORK, Aug. 3.—Representatives of the American Chain Co. declined to-day to state what policy would be pursued in reference to the Weed chain when the basic patent covering it, No. 768,495, runs out Aug. 23 next. The only comment made was that "we have not been asleep in reference to the Weed patent." The inference was that the company has prepared to put an improved tire chain on the market. It was said an announcement covering the subject would be made about Sept. 1.

When the patent expires there will be nothing to prevent the manufacture of the Weed chain by anyone who cares to produce it. Infringements will be prosecuted up to the end of this month, however.

The Parsons patent, No. 723,299, under which tire chains were manufactured by the American Chain Co., expired on March 24, 1920.

# Harley-Davidson Cuts Motorcycle Prices

NEW YORK, Aug. 1.—Harley-Davidson Motor Co. has announced price cuts ranging from $105 to $130 on all models. The cut took effect August 1. The price changes on the various models are as follows: 74 cu. in. electric twin reduced from $520 to $390; 74 cu. in. magneto twin, from $485 to $360; 61 cu. in. electric twin, $485 to $365; 61 cu. in. magneto twin, $450 to $335; sport electric twin, $445 to $340; sport magneto twin, $415 to $310.

Reductions have also been made in side-car prices ranging from $40 to $50.

Other price reductions are looked for in the near future. It has been announced that the Hendee manufacturing company will make reductions on Sept. 1, but the extent of the cut has not been determined. Prices of the Cleveland motorcycle have been cut twice within recent months, while the makers of the Henderson and Excelsior machines made some reductions a few weeks ago.

### NEW PRICES FOR REO

DETROIT, Aug. 1—New prices have gone into effect on the Reo touring car and roadster. The new prices for the touring car and roadster are $1,650 as compared with $1,850. Series B coupe for $2,700.

### CYCLONE TRUCKS REDUCED

GREENVILLE, S. C., Aug. 3—The Cyclone Starter & Truck Co. has reduced the price of its Cyclone truck from $2,800 to $2,685. This price includes steel cab top with curtains, windshield, starting and lighting equipment.

# England Hears U.S. May Produce There

## Rumor Also Has It Americans Likely to Take Over Existing Factories

LONDON, July 20 (*By Mail*)—One of the topics which is being discussed by the British automobile trade concerned with the overseas market, is the curious and vexatious irregularities arising out of recent revisions of the preferential tariff in British dominions.

The Indian import rate has been raised to 20 per cent from 7½ per cent, the New Zealand preferential rate is now 10 per cent whereas in Australia it has been reduced to 5 per cent, in South Africa it is only 3 per cent and in Canada it is 7½ per cent. British critics are pointing out that a preferential rate of 5 per cent is insufficient to tempt British makers having regard to the cost of freight, etc.

It may be added that there are continual rumors that American factories will be opened here, or, at least, the taking over of existing ones by American interests for meeting the tariff and other restraints for which a section of the British trade and fiscal reform party are clamoring. It is too soon to deal with the matter, but there is support for certain rumors in well informed trade quarters.

# Palmer Defends Self in Bosch Plant Auction

(*Continued from page* 237)

In denying favoritism to Kern, it is asserted by Palmer that he did not appoint Arthur T. Murray managing director of the American Bosch but that Murray was elected upon recommendation of Palmer as alien property custodian. Palmer also denies the appointment of directors or any attempt to discourage competition for the purchase of the assets or that he sought to have them sold to Kern.

Palmer denies that Kern caused the company to issue $1,800,000 in 7 per cent promissory notes and then sold the notes, retaining the proceeds for himself. He also denies that Kern pretended to bring about a dissolution of the company, saying that Kern lawfully brought about its dissolution Jan. 22, 1919, a few days after the American Bosch Magneto Co. was incorporated at Albany.

### SEIBERLING AT REPUBLIC

YOUNGSTOWN, Aug. 4.—F. A. Seiberling, former president of the Goodyear Tire & Rubber Co., has inspected the properties of the Republic Rubber Corp. in Youngstown and Canton, now operating under a receiver. Seiberling may purchase the Republic business and plants and merge them with the Newcastle Tire & Rubber Co., which he has acquired.

# Will Wage Hot Fight on Federal License

## A. A. A. Summons Owners to Battle Against Additional Impost

WASHINGTON, D. C., Aug. 2—Appeal has been made by the American Automobile Association to 10,000,000 owners of motor vehicles to oppose the proposal of Secretary of Treasury Mellon for a $10 flat tax on automobiles irrespective of power or size. Statistics have been sent broadcast showing that automobilists are already carrying more than their share of tax burden and that further advances in rates would be obviously discriminatory and iniquitous.

It is said that Chairman Fordney of the House Committee on Ways and Means is opposed to the Mellon proposal for a tax on automobiles because he believes cars of small power should not pay the same rate as larger cars and heavy trucks. The recommendations of the Treasury Department have precipitated a bitter fight in Congress which is not confined to party lines. It is expected that representatives of agricultural districts where there are large numbers of motor vehicles in use will fight the enactment of a motor tax.

Because it is primarily a tax which hits the user of automobiles, the American Automobile Assn. is handling the movement against the Mellon measure but has the support of the National Automobile Chamber of Commerce and other large business organizations. Every automobile club in the country has been asked to bring pressure to bear on congressional leaders and with 10,000,000 automobile owners protesting, Congress is expected to give due thought to the possible economic and political effects of an automobile tax. Attention of House committee on Ways and Means has been called to the fact that car owners are paying a multitude of taxes on their cars including registration fee, driver's license fee, personal property tax, municipal franchise tax, motor fuel tax and other local assessments.

The excise taxes on automobiles will probably be maintained.

# Introduce Bill Asking for Special Motor Tax

(*Continued from page* 237)

is qualified to operate a motor vehicle upon a public highway.

Section 2 of the Appleby bill would authorize the reciprocity of licenses between all States. A measure of a similar nature is now pending before the Congress and is known as the Pittman-Sweet bill. The Federal registration tax would be affixed and would form a part of the State license tax, which tax could be recognized by the authorities of the several States, as permitting the owner of the automobile to whom the license was issued, to operate the machine within the confines of any State he may be visiting, or through which he may be passing, without any additional registration or the securing of any other license or tax, or the payment of any additional tax.

### Make New Plea for Sales Tax

WASHINGTON, Aug. 2—Another strong plea was made for the sales tax by representatives of the automobile industry, in conference with Secretary of Commerce Hoover and Secretary of the Treasury Mellon, here. These administrative leaders were unable to hold out any hope for the adoption of the sales tax program because the Administration has advised Congress that a sales tax would not be recommended unless an additional assessment was needed for a soldiers' bonus. Secretary Hoover refused to commit himself and Secretary Mellon indicated that he could not run counter to his present program of tax revision.

The House Committee on Ways and Means has ruled out all testimony regarding the sales tax because it considered it a waste of time to continue hearings, inasmuch as they have already determined that the sales tax would not be incorporated in a new revenue bill.

C. C. Hanch, Chairman of the Tax Committee of the N. A. C. C. told Secretary Hoover that over-taxation and under taxation has been disturbing business equilibrium. He declared that the excise tax was a war measure and should be repealed in all fairness to the automobile industry. It was his contention that this tax is a "stigma" tax upon the automobile and other industries and forms a sales resistance which unbalances normal consumption.

# Hare's Motors Will Go On as Selling Agents

NEW YORK, Aug. 2—Notwithstanding the impending reorganization of the Mercer Motors Co. and the cancellation by Hare's Motors of its contract with that corporation, Hare's Motors will not be dissolved but will continue to function as at present. It will continue as the selling agency for the Kelly-Springfield Truck Co. and probably for the Locomobile Co.

The arrangement with Locomobile will depend upon the decision of the creditors with regard to an extension of their claims pending a possible reorganization, but it is considered practically certain such an agreement will be reached. The extension granted by Locomobile creditors expired July 31 but between 85% and 90% of the creditors already have agreed to a further extension which will run for at least six months.

There will be no change in the personnel of Hare's Motors and even if it is found necessary to liquidate Locomobile it is expected that other lines will be added as opportunity offers.

Stockholders of Mercer Motors will meet Aug. 11 to pass upon the reorganization plan and its ratification is regarded as certain.

# July Sales in Oregon Well Up with 1920

## Many Deferred Deliveries Cause Poor Showing in Figures for June

PORTLAND, ORE., Aug. 1—While registration figures on the sales of new cars throughout Oregon indicated that the month had been scarcely one-third normal, the month of July in Oregon, according to indications, will be unusually heavy in sales of new cars, and when registration figures are known within a few days it is expected they will show the month this year well up with sales of July 1920.

The reason for the poor showing in June was that dozens of buyers of cars during the last portion of that month asked that delivery be deferred until after July 1, thus putting off registration until after that time. This was done because, according to the Oregon registration laws, all licenses taken out during the first six months of the year must be paid for on the full yearly basis, while after July 1 one-half year licenses are required. Thus by deferring taking delivery on cars which they had purchased until after the first of the month purchasers were able to have their license fees cut in half.

Total registrations for June this year in Oregon were 2115 automotive vehicles, according to the report of the Secretary of State's office, of which number 889 were new passenger cars and trucks. During the first week of July registrations were 4200 cars, approximately half of which were new automobiles and trucks. Thus during the first week of July twice as many cars were licensed as during the entire month of June.

# Milwaukee Makers All Operating at Capacity

MILWAUKEE, WIS., Aug. 2—So much progress has been made by distributors and dealers in virtually all sections of the United States during June and July in the merchandising of passenger cars that manufacturers in this district are operating on the heaviest production schedules in effect since March 1. The same is true of manufacturers of motors, frames, transmissions, axles and other parts, which forms an important part of the industry of Milwaukee and southeastern Wisconsin. While substantial increases in output were effected during June, it was not until July 1 that operations assumed a more nearly normal stage and during the month just closed increases in output were made steadily and regularly, demands of distributors and dealers being more regular. At the close of July the Milwaukee plant, or four-cylinder car division of Nash Motors Co., was putting out 50 cars a day, which is capacity in the present works, employing 1000 men on a straight 8-hour schedule.

# June Sales Statistics Show 15.19% Decline from May in Business of 300 Motor and Accessory Manufacturers

NEW YORK, Aug. 1—Sales statistics compiled by the Motor and Accessory Manufacturers Association from its members, who include the leaders in this branch of the automotive industry, show that there was a decline of 15.19 per cent in June as compared with May. This is the first month of the year to show a falling off in sales, as compared with the preceding month, although the increase for May was very small.

The total of past due accounts showed a small increase in June as compared with May. It was the first month of the year when they were not whittled down. It was encouraging to note, however, that there was a further material reduction in the total of notes outstanding.

The figures for the first six months, compiled from the reports of 300 members of the M. A. M. A., follow:

| Month | Total Purchases | Per Cent Change | Total Past Due | Per Cent Change | Total Notes Outstanding | Per Cent Change |
|---|---|---|---|---|---|---|
| January ... | $6,264,587 | | $8,099,727 | | $4,359,871 | |
| February ... | 10,408,962 | 66.15 Inc. | 6,717,165 | 17.07 Dec. | 6,063,118 | 39.08 Inc. |
| March ..... | 20,120,386 | 93.30 Inc. | 5,603,992 | 16.57 Dec. | 5,069,877 | 16.38 Dec. |
| April ..... | 26,746,580 | 32.93 Inc. | 5,352,271 | 4.49 Dec. | 5,371,086 | 5.94 Inc. |
| May ..... | 26,781,350 | 00.13 Inc. | 4,505,176 | 15.64 Dec. | 4,460.355 | 16.77 Dec. |
| June ..... | 22,703,414 | 15.19 Dec. | 4,720,973 | 4.79 Inc. | 4,012,670 | 10.37 Dec. |

# Peak of Unemployment Reached in Kansas City

FORT WAYNE, IND., Aug. 2.—The unemployment peak, it is believed, has now been reached and with the approach of fall there will no doubt be a distinct improvement in local conditions. A survey of twenty-one employers of the city shows that during the month of July about 10,000 men were totally out of work for the entire month in this city, or worked only a few days. This is the greatest number that has been out of employment in this city during any one month yet.

Some of the city's largest industries are doing little. The General Electric Co., for instance, which at the height of its greatest activity employed 7300, now has about 3000 on its payroll and they are not working full time. These 3000 have just been informed of a wage cut of ten per cent immediately effective, this cut being the second ten per cent reduction of the year.

It is interesting to know that the local gasoline auto pump companies are standing up the best of any of the local industries. S. F. Bowser & Co. have been working 100 men at nights for some time. The Wayne Oil Tank and Pump Co. is quite busy, as is the Tokheim Pump Co.

# North Dakota Field Expected to Improve

(*Continued from page* 243)

mers. Business last fall with farmers was practically nil, a fact which should be kept in mind.

One tractor distributor in Devils Lake hopes to sell twice as many tractors as last year, and that the automotive sales of the territory will be greater this fall. Even in the Fargo area where crop conditions are about the same as a year ago, more country sales are expected this fall than last by distributors handling medium priced cars.

2.—There is general agreement that business for the next twelve months will show an improvement over the last twelve. The farmer will be a better buyer. He will be in better humor. He will have liquidated many obligations and while he may not have much ready money he will be more favorably disposed. His credit will be better. Automotive apparatus has been wearing out during the past twelve months and in agricultural areas of sparse population the motor car is such a necessity that the farmer cannot do without it. There is no such thing as a luxury automobile in such a State.

3.—The purchasing capacity of towns and cities in North Dakota is not so definitely agreed upon by distributors in different cities. Minot distributors believe that city buying in the next twelve months will reflect crop conditions, and that buying will be heavier. In cities like Fargo the general feeling is that city buying will be in proportion to crop conditions. The same view is held by Grand Forks distributors.

# Wainwright Arranges 11-Hour Force at Night

CONNERSVILLE, IND., Aug. 2—The Wainwright Engineering Corporation is starting a night force this week on an eleven-hour shift to supplement the nine-hour day force. This means that business is increasing, as has been the case since the first of the year. The trade in over-sized pistons has surpassed the most optimistic hopes.

So far the Lexington business to date for 1921 is only 12 per cent below 1920, and 1920 was 116 per cent above 1919, according to President F. B. Ansted's statement to department heads. Since the July 1 cut in price the orders for cars are coming at the rate of 250 per week, which is fairly normal, as compared with July, 1920. The price cut has satisfied the sales department.

## TRANSPORT TRUCKS CUT

MOUNT PLEASANT, MICH., Aug. 3.—Price reductions ranging from 11 to 25 per cent on three of the four models comprising its line, are announced by the Transport Truck Company. The 1-ton model is reduced from $1,850 to $1,395; 1½-ton from $2,250 to $1,995; 3½-ton from $4,195 to $3,885. The price of $2,785 on the 2½-ton is the same.

# METAL MARKETS

**As to the trend of the steel market there appears to be only one opinion. Prices are headed for still lower levels. Considerable divergence prevails, however, in views as to how and when these declines will come about. Majority sentiment inclines to the belief that prices will continue to sag, and that for the immediate present declines of about $1 per ton may be looked for as a weekly occurrence. In other quarters a more spectacular making over of the situation seems to be anticipated. A Sharon, Pa., correspondent wired early this week that "it is possible that within a week or two steel purchasers will see such a drop in prices as will convince them the bottom has been struck; this, it is said, will turn the industry back to a forward course." Conservative buyers refuse to permit such prognostications, even though they prove correct, to interfere in the least with the program which they have mapped out. They recognize that a period of declining prices is ahead, interrupted periodically by brief reactions. Their aim is to cover their wants as much as possible in the periods of declines and to avoid the necessity of figuring as buyers in periods of short-lived upward spurts of the market. They know that the buyer who would stay out of the market until the last $1 a ton decline has been registered is usually obliged to place orders in a rising market. It is only natural that steel producers strive to bring about at as early a date as possible a return to stability.**

**Pig Iron.**—More inquiries for deliveries over the third and fourth quarters are in the market. Up to the middle of July only small tonnages for immediate shipment were sought, but now a decided upward swing in buying activity has set in. Prices are relatively firm.

**Steel.**—Full-finished automobile sheets, 22-gage, at around 4.70c. base, are somewhat more firm than the general run of the sheet market, and this in spite of the fact that the demand is rather easier. High-grade blue annealed sheets for crank cases which sold at 2.50c. base, reflect a somewhat lower figure than the 2.25c. quotation for No. 10, now "publicly" quoted. More inquiries are noted for strip steel, the cold-rolled being quoted at 4.25c., although the leading manufacturer of low-priced passenger cars is said to have bought 800 tons at considerably below this figure. Although producers of cold-finished steel bars contend that on the basis of a conversion charge of $15 a ton they can not shade the 2.50c. base price (hot-rolled bars have now settled down to 1.75c. base), automotive consumers appear to be still offish. Inquiries for bolts and nuts continue to come out and some warehouse stock has passed into automotive consumption.

**Aluminum.**—The market continues in abeyance. Importers are contesting every inch of the market and some very low offers are reported.

**Copper.**—The market for the red metal has turned intensely weak and offers of spot metal at as low as 12c. have been turned down.

**Tin.**—The visible world's supply is placed at 65,000 tons with a continuance of 2000 tons more production than consumption every month. Hence the failure of consumers to respond to prevailing low prices is easily explained.

**Lead.**—Storage battery demand is slightly better, but the market generally continues easy to weak.

## BANK CREDITS

*Written exclusively for* AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

As a result of an increase during the week of $22,000,000 in gold and $3,000,000 in other cash reserves, the total reserves of the Federal Reserve System on July 27 stood at $2,685,000,000. Total deposits increased during the week by $2,000,000, due to an increase of $8,000,000 in the member bank reserve account, and a decrease of $6,000,000 in Government and other deposits, total deposits standing on July 27 at $1,695,000,000. On the other hand, note circulation decreased by $27,000,000 to $2,537,000,000. By reason of these changes the ratio of reserves to deposit and note liabilities combined, increased from 62.5 per cent on July 20 to 63.4 on July 27, while the ratio of gold reserves to note circulation after setting aside 35 per cent against deposit liabilities, increased from 80.6 per cent to 82.4 per cent. These ratios compared with 42.2 per cent and 49.2 per cent on July 30, 1920.

Bills discounted, representing the loans of the Federal Reserve System, declined $36,000,000 during the week, while bills bought declined $4,000,000; the total of bills on hand July 27 being $1,670,000,000. Since Nov. 5, 1920, when bills on hand were at their highest point, $3,127,000,000, a total decline of $1,457,000,000 has taken place, of which $553,000,000 represents the decline in commercial bills discounted. These figures suggest the contraction in the demand for credit since last autumn.

The contraction in the demand for credit is further evidenced by a continued lowering of money rates, which affords a sharp contrast in comparison with conditions a year ago when money was over 8 per cent. The tendency toward easier money, which has been noticeable for the past month, took an extreme form on Thursday of last week when call money dropped to 3½ per cent, the range of the week being 3½ per cent to 5 per cent, compared with a range of 5 per cent to 6 per cent in the previous week. Renewal rate at the end of last week was 4½ per cent. This is the lowest since November, 1919. Time money ranged from 5½ per cent to 5¾ per cent for all maturities compared with 6 per cent the previous week, but demand was light and comparatively little business was contracted. Prime bills for 60 and 90 days' maturities sold at from 5¾ per cent to 6 per cent, other names ranging ¼ per cent above the rate for prime bills, which compares with a rate of 6¼ per cent to 6½ per cent in the previous week.

## FINANCIAL NOTES

**Continental Casualty Corp.,** New York, in a statement of condition of June 30, shows cash in bank and on hand of $2,049,242.33 and cash in trust from notes and acceptances paid $1,039,714.34. Bills receivable amount to $841,310.75, notes and acceptances in trust, $4,778,376.34, bills receivable in trust securing special collateral loans, $2,822,428.81. Accounts receivable are $431,381.63, investments $890,925.21 and total resources of $13,242,690.31. Collateral trust gold notes come to $4,975,000 and bills payable, including special collateral loans, $4,020,334.26.

**Biggam Trailer Co.,** Milwaukee, a new corporation has organized with a capital stock of $250,000 preferred, plus 1,500 shares of common stock without par value, to engage in the manufacture and sale of trailers and trailer trucks.

**Oilglar Co.** of Milwaukee, manufacturing transmission devices, has increased its authorized capitalization from $150,000 to $300,000 of preferred stock and 25,000 shares of common stock at no par value.

**B. F. Goodrich Co.** has declared a quarterly dividend of 1¾ per cent on preferred stock, payable October 1 to stockholders of record September 21.

**Lee Rubber & Tire Corp.** has declared the regular quarterly dividend of 50 cents a share, payable September 1 to stock of record August 15.

**Chevrolet Motor Co.** of Delaware has declared a dividend of $3 a share, payable August 2 to stock of record July 30.

## Drake, N. A. C. C. Official, to Aid in Census Taking

WASHINGTON, Aug. 1—J. Walter Drake will represent the N. A. C. C. on a special committee appointed by the National Association of Manufacturers to co-operate with the Bureau of the Census in compiling the 1921 biennial census of manufactures. In addition, the statistics will be given the Bureau for publication monthly as to production.

The committee will confer with Bureau officials about August 13, regarding the simplification of questionnaires which will be sent out to manufacturers employing five or more persons and it is proposed to limit the distribution to establishments whose products have an annual value of $25,000, and to approximate values below that figure, based on logical figures, which the conference held to be a logical plan in view of the fact that it was shown that 35 per cent of the plants have an annual production of less than $100,000 each. It also will be the purpose of the census to set forth only essential facts.

### REVERE SAVED BY COURT

LOGANSPORT, IND., Aug. 2.—Judge Souder has ruled that the factory of the Revere Motor Car Corp. should not be sold by the receiver and that the plant shall continue to be operated under receivership of the Citizens Loan and Trust Company of Logansport. The receiver will continue to meet orders for cars. Since being placed in the hands of a receiver several months ago an average of one car a week has been completed at the plant.

### DRUMPELMANN WITH SAXON

W. L. Drumpelmann, recently resigned as assistant sales manager of Hudson-Essex, has been elected vice-president and director of sales of the Saxon Motor Car Corp., succeeding C. H. Page.

## Transfer of Samson Truck Almost Ended

### Removal of Plant from Flint, Mich., to Janesville About Completed

JANESVILLE, WIS., Aug. 2—The transfer of the Samson motor truck assembly plant from Flint, Mich., to the headquarters and main works of the Samson Tractor Co. at Janesville, Wis., has been going on throughout the month of July and is now about completed. From 20 to 25 carloads of truck parts, chassis, axles, etc., were received from Flint each week. The motor truck operation will be concentrated at Janesville, although the manufacture of certain parts will be continued at Flint. The Samson works at Janesville already form one of the largest units of the General Motors group and a five-year building program which is now about 40 per cent completed will make it probably the largest plant in the world devoted entirely to the production of agricultural equipment, which includes Samson tractors, Samson farm trucks, Samson nine-passenger farm cars, Janesville tractor implements, etc. J. A. Craig is president and general manager of the Samson Tractor Co., with headquarters at Janesville.

## Oshkosh Tractor Buys La Crosse Interests

LA CROSSE, WIS., Aug. 1.—The Oshkosh Tractor Co. has purchased the entire assets of the La Crosse Tractor Co., which, for the past five years, has manufactured the Happy Farmer tractor, later known as the La Crosse tractor. All the machinery, tools and material will be removed to Oshkosh as soon as an adequate factory can be completed and production of the same models will be continued there. Work on the factory will be started at once.

The plans call for a main building 150 x 500 feet, modernly equipped. The Oshkosh Tractor Co. is capitalized at $1,500,000 and is headed by A. D. Paine as president and general manager. Paine also is manager of the Wisconsin Tractor Sales Co. I. G. Hickman of Milwaukee is vice-president and C. C. Shanor is secretary, treasurer and sales manager. L. W. Melcher, factory manager and designer of the La Crosse tractors, will act in the same capacity for the Oshkosh company.

### DYER BILL FAILS TO PASS

WASHINGTON, Aug. 3—Efforts to pass Senate bill 1060, which is an amendment to "an act to punish the transportation of stolen motor vehicles in interstate or foreign commerce," failed in the House this week and the measure was restored to its place on the regular House calendar. It is known as the Dyer bill and provides a penalty of five years or a fine of $5,000.

## MEN OF THE INDUSTRY

**R. S. Abbott,** for the past ten years manager of the Atlanta district for the Ford Motor Co. and in charge of the large assembling plant there, has been promoted to the management of the district with headquarters at Houston, Texas. This district includes a large part of Texas and all of Mexico. Abbott is succeeded by W. W. Mitchell, for the past two years assistant manager of the assembling plant at Oklahoma City.

**Ferris R. Miller,** formerly of the publicity department of the Goodyear Tire & Rubber Co., who was transferred to California last year as publicity manager for the new Los Angeles Goodyear Co., has resigned to become commissioner in charge of the Los Angeles Better Business Commission, established to stop misrepresentation in advertising and questionable business methods among merchants.

**Jos. C. de Varona** has been appointed special representative for the Maxwell Motor Corp. De Varona has been with the General Motors Co. for the past five years. He had charge of the Modern Housing Corp. at Flint, Mich., when the General Motors subsidiary erected one thousand houses for its employees. More recently he was sales manager of the Buick branch at El Paso, Texas.

**Roy Davey,** who has been manager of the Detroit branch for the American Bosch Magneto Corp., has been given larger responsibilities at the main office in Springfield, Mass., as acting manager of the manufacturers' trade department. Davey was formerly advertising manager of the Chalmers and sales manager for Bethlehem Motors.

**Sterling H. Keene,** service manager of the National Car & Vehicle Corp., has been granted a leave of absence to enter the U. S. Public Health Service Hospital No. 60, at Oteen, N. C., so that he may completely recover from the effects of being gassed during military service in France.

**C. H. Landsittel** has become sales engineer of the Climax Motor Devices at Chagrin Falls, Ohio, a suburb of Cleveland. He formerly served as director of purchases for the Templar for three years, and prior to that in the same capacity for the Haynes at Kokomo.

**Paul Jones** will direct the new correspondence supervision department of the Franklin Automobile Co. Jones goes to the Franklin company from General Motors in New York, with whom he has held a similar position.

**Alfred Reeves,** general manager of the National Automobile Chamber of Commerce, is spending his vacation at Cape May, while **J. S. Marvin,** assistant general manager, is spending three weeks at Manchester, Vt.

**Klare F. Covert** has been appointed as sales manager in charge of the general sales offices of the Harrison Radiator Corp. of Lockport, N. Y. Covert succeeds H. R. Lewis, who resigned.

## INDUSTRIAL NOTES

**National Gauge & Equipment Co.,** of La Crosse, Wis., manufacturing gasoline and oil measuring gauges, pressure indicators, meters and similar motor car equipment, is now operating at from 75 to 80 per cent of capacity, a substantial gain over July 1, when it has reached 60 per cent of capacity. Current orders are of a volume insuring capacity operations by early fall.

**Emerson-Brantingham,** Rockford, Ill., farm implement and tractor manufacturers, have closed for inventory, but Charles S. Brantingham, president, said the reopening in September will not be determined until trade conditions become clarified. The plant has been operating with about 50 per cent force on 60 per cent time.

**Clark-Turner Piston Co.** of Los Angeles, has completed a modern factory building containing approximately 50,000 square feet of floor space. Production of De Luxe pistons has been greatly increased and the business has been developed not only in the United States but in many foreign countries.

**Temme Spring Corp.** recently signed a contract with American Autoparts Co., Detroit, under which the entire output of replacement springs of the Detroit plant will be handled by the Temme Company.

**Fisher Body Co.,** Cleveland, is completing its local plant and machinery has been installed. Production has not started, but the completion of drawings and die plant can be placed in operation within 60 days.

**H. H. Franklin Mfg. Co.,** Syracuse, will operate five days a week during the balance of the summer, instead of five and a half days as at present. Production will be maintained at around 40 cars a day.

**Rolls Royce Co. of America** has closed its plant in East Springfield, Mass., for five weeks. Approximately 800 employees have been at work in the factory, which has been operating on a full-time schedule.

**Jefferson Rubber Co.,** Jefferson, Wis., has purchased approximately $50,000 worth of new machinery for immediate installation to bring the capacity to the point required by current orders.

**Ford Motor Co.** has begun the erection of a new steel building for the welding department of its Northville, Mich., factory. The output there is averaging 57,000 valves and valve stems daily.

**Greenfield Tap and Dye Corp.** which closed its plant for July is beginning to open up departments and is employing more than 300 hands.

**Franklin Automobile Co.,** retail orders for July to date exceed those received during similar periods of either April, May or June.

**Hartford Scripps-Booth Co.,** has filed a certificate of dissolution.

## Reo Returns to Old Home Under J. Frank Witwer

KANSAS CITY, Aug. 3—The Reo passenger car and truck wholesale and retail distribution for Kansas City and territory returned Aug. 1 to its original home, The Southwest Motor Company. Reos were sold by this company at 1612 and 1614 Grand Ave. from 1910 to 1919, making the longest continuance representation in one location in Kansas City motor car history.

The company has the same territory for Reos as before, including western Missouri and northern and eastern Kansas. In the interval of two years that Reos have been handled by another company, the Southwest Motor Co. has distributed and retailed Jordan passenger cars. There will be a separate traveling force and sales organization for the Jordan. The company has not handled a truck in the past two years. J. Frank Witwer is president and general manager of the Southwest Motor Co.

# Fordney in Favor of Graham Measure

### Resolution Will Be Pushed—Dealers Believe Bill Will Protect Them

WASHINGTON, Aug. 3.—Chairman Fordney of the House Ways and Means committee has indicated that special attention will be given the Graham resolution calling for a levy of 300 per cent on reimported war supplies. It is expected the resolution will be reported out either this week or next, in order that it may be considered in the House before debate begins on internal tax revision. Automobile dealers believe that the Graham resolution will afford better protection against underselling by foreign speculators than the tariff bill pending.

The Graham resolution is more drastic than the provisions carried in the House tariff bill and it levies specific duties which are prohibitory. With the resolution through the House, its passage could be expedited in the Senate and the resolution would become effective several weeks before the tariff bill is enacted, thus putting an immediate check on reimportation activities.

It is known that majority members of the Ways and Means committee are in favor of this proposition as interim legislation. They are receiving numerous complaints to the effect that European and American speculators are selling American war supplies at prices which defy American competition.

## Prudden Has Best Day Since May a Year Ago

DETROIT, Aug. 3.—Production in the Prudden unit of the Metal Wheel Corp. at Lansing on July 26 exceeded any previous 10-hour output. The biggest previous day was in May, 1920. The Prudden and other units of the corporation now are operating 10 hours a day with Saturdays off. The plants will be operated Saturdays this month if shipments are not delayed.

The Michigan Screw Co. at Lansing reports better business in July than was anticipated. Several unexpected orders were received and the output was up to the 50 per cent mark the entire month. Operations are expected to slow up this month but prospects are bright.

### CUT KALAMAZOO TRUCKS

KALAMAZOO, MICH., Aug. 3.—Reductions ranging from $300 to $425 on all models of its trucks were announced by the Kalamazoo Motors Corp. Two new models also will be added to its line. The model G-1 1½-ton is reduced from $2,800 to $2,495; model G-2 1½-ton from $3,100 to $2 800; the 2½-ton from $3,700 to $3,275; the 3½-ton from $4,300 to $4,000; the 5-ton from $4,800 to $4,500. A new 3-ton model will sell for $3,700 and a special road builders 5-ton new model for $4,800.

# Calendar

### SHOWS

Sept. 5-10—Indianapolis, Automobile and Accessory Show in conjunction with Indiana State Fair, conducted by Indianapolis Automobile Trade Association, John B. Orman, Mgr.

Sept. 28 - Oct. 8 — New York, Electrical Exposition, 71st Regt. Armory, Electric Equipment, Machinery and Vehicles.

Nov. 27-Dec. 3—New York, Automobile Salon, Hotel Commodore.

January — Chicago, Automobile Salon, Hotel Drake.

Jan. 7-13—New York, National Automobile Show, Madison Square Garden, Auspices of N.A.C.C.

Jan. 28-Feb. 2—Chicago, National Automobile Show, Coliseum, Auspices of N.A.C.C.

Sept. 9 to 17—Ottawa, Ont., Can.—Ottawa Motor Show.

Feb. 6 to 11—Winnipeg, Can., Automotive Equipment Show, Western Canadian Automotive Association.

### FOREIGN SHOWS

September—Buenos Aires, Argentina, Passenger Cars and Equipment. La Pabellon de las Rosas. Automovil Club Argentino.

September—Buenos Aires, Argentina, Cars, Trucks, Tractors, Farm Lighting Plants and Power Farming Machinery. Palermo Park; Sociedad Rural Argentina.

September—Luxemburg, Luxemburg, Agricultural Sample Exhibition.

Sept. 5, 1921—Constantinople, Traction trials under the direction of the Turkish Ministry of Agriculture.

Sept. 23-Oct. 2—Berlin, German National Automobile Show, Auspices of German Automobile Mfg. Ass'n and German Automobile Club.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

Nov. 4-12 — London, British Motor Show, Society Motor Mfrs. and Traders.

November 7-14—Paris, Seventh International Exposition of Aerial Locomotion in the Grand Palais of the Champs Elysees, Held by the Chambre Syndicale des Industries Aeronautiques.

March, 1922—Santiago, Chili, Annual Automobile Show.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Associcao Automobilista Brazileria.

### CONVENTIONS

Sept. 14-15-16—Detroit, Credit Convention Motor and Accessory Manufacturers Association.

Oct. 12-14—Chicago, Twenty-eighth Annual Convention National Implement & Vehicle Ass'n.

Nov. 22—New York, Convention of Factory Service Managers, National Automobile Chamber of Commerce.

Dec. 27-29—Chicago, American Society of Agricultural Engineers, Auditorium Hotel.

### RACES

Labor Day—Uniontown, Pa., Autumn Classic.

## Milwaukee Firm Plans to Keep All Employed

MILWAUKEE, WIS., Aug. 3—To keep its entire capacity employed to a maximum, the Beaver Mfg. Co. of Milwaukee, a large manufacturer of motors for passenger cars, trucks and tractors, has started a campaign for patronage from garages and private owners for repairs and replacement work. The works cover 100,000 sq. ft. Large newspaper display space is being used to announce the new department, as follows:

"The greatest fear of the passenger or commercial car owner is motor trouble. Too much time and money is lost while repairs are being made. We can save you time and money and insure better performance when you need repair service or parts of any description. Our equipment permits us to take work of any size. Each individual order receives prompt, efficient attention. Over nineteen years of motor building has given us knowledge of materials and workmanship which you can use to advantage.

"We have in stock, for all makes and models of motors: Bearings, either connecting rod or main, of any type; copper asbestos cylinder head gaskets; pistons, piston pins, rings and bushings, either standard, oversize or special; timing and starting gears; valves, etc. We can regrind your cylinders and furnish special light weight pistons. You can get quick, accurate service on any crankshafts to be reground."

As a special offer, the Beaver company makes a price of $20 for regrinding Ford cylinders, including oversize pistons, complete with rings, pins and bushings.

## Sale of Holton Assets Is Approved by Court

INDIANAPOLIS, Aug. 3 — The sale of the Holton Tractor Co. assets was approved by Judge Solon J. Carter in Superior Court, before whom a receivership action by creditors of the company was pending. The tractor company, while a Delaware corporation, had all its assets in Indianapolis, together with factory equipment, and plans had been made for the manufacture of the tractor on a large scale here. Lack of capital, however, prevented the company from making a success and last December the company was placed in the hands of a receiver.

The tractor company was sold to Elwood Haynes, of Kokomo, president of the Haynes Automobile Co., other Kokomo business men and George J. Marott of Indianapolis. Mr. Haynes will be president of the new company, Mr. Marott and A. G. Seiberling, vice-presidents, John Powell, secretary, and Mr. Marott, Mr. Seiberling, Mr. Powell, Mr. Haynes, J. W. Johnson and Si McQuiston, directors. The new company will be a $2,000,000 corporation, manufacturing a tractor, another tractor known as the Powell tractor, and other features acquired by the company after months of experimenting. The new product will be known as the Haynes tractor.

The creditors of the Holton company will receive about $100,000 in 7 per cent cumulative preferred stock in the new corporation, and persons who held common stock in the company will receive part of their holdings in common stock of the new company, common stock aggregating from 25 to 33 per cent being received by these holders of common stock. It is said practically all of the creditors had signed agreements accepting the proposition.

## Jersey Firm Takes Over Chevrolet Branch Plant

CAMDEN, N. J., Aug. 3—The Millwood Motor Car Co. is a new organization which has taken over the distribution and retail sales of Chevrolet cars for the Camden territory. With the change, the factory branch of the Chevrolet Motor Co. here will be discontinued. The Millwood organization takes over the building, stock of parts and organization of the factory branch.

## New Mercury Car Soon to Be Made in Canada

MONTREAL, QUE., Aug. 3—The Canadian Automobile Corporation has started factory operations at Lachine where it has taken over the plant of the Rapid Tool and Machine Co., Limited, pending the erection of a permanent plant in Longueuil parish, a site which was purchased recently. The car to be produced is the Mercury Six.

The actual assembly of parts was started three weeks ago. Those in charge of the factory are G. E. Brennan, and H. Potter, formerly engineer and production expert to Stevens-Duryea. All engineers in charge of the factory, which is expected to give employment to about 150 men, have been connected with motor construction for long periods. The directors of the company are F. W. Stewart, vice-president Cluett, Peabody Co., of Canada, Limited, and an ex-chairman of Montreal section of the Canadian Manufacturers Association, chairman of the board, H. W. Austin, managing director of Perrin Kayser, Ltd., vice-president; J. D. Henderson; D. L. Harrington, president and general manager Rapid Tool and Machine Co., Ltd. M. H. Potter, John MacNaughton, and R. J. M. Cantell, all of Montreal.

The site purchased at Longueuil comprises 163,000 sq. ft., and the company is contemplating erection in the near future. Arrangements have been made with the Grand Trunk for a siding.

## French Air Exposition to Be Held November 12

PARIS, July 20 (By Mail)—The seventh French aeronautical exposition will be held at the Grand Palais in the Champs Elysees Nov. 12-27. No exhibition was held last year. The general classification of exhibits includes aerostats, heavier than air apparatus, engines and propellers, aerial navigation, motor boats, machine tools and raw material, transportation and housing.